SCIENCE

VOL. 96 FRIDAY, JULY 24, 1942 No. 24

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office [illegible] permanent [illegible] in the Smithsonian Institution [illegible], Washington, D. C.

SOME BASIC CONSIDERATIONS IN PLANNING FOR RESEARCH [illegible] SOUTHERN PROBLEMS[1]

[illegible] O. H. BOYD

[illegible] GEORGIA

THERE are so many existing [illegible] scientists, as well as others, have [illegible] weary of the addition of more [illegible] more or less duplication of purpose, [illegible] attend and more papers to be read [illegible] ization which is to succeed mus[illegible] terms of a distinct purpose and [illegible] The Southern Association of Scien[illegible] organized with the purpose of [illegible] science and industry in the South in [illegible] scientific research upon the problems [illegible] of the South, may, I believe, be adequ[illegible] [illegible] is organizat[illegible] under the sponsorship and [illegible] who are prompted by a larger consideration [illegible] own research for the industries which they represent. Recognizing the limitations under which the South is laboring and realizing the opportunities which lie here, and the part which scientific research and industry may play in the development of these, they have committed themselves to the task of bringing together the [illegible] of scientists in this area and the re[illegible] southern industries to contribute what they [illegible] building of a greater South. This is [illegible] and one which has not hitherto been undertaken [illegible] a comprehensive way in the South [illegible] Scientific [illegible] is capable of [illegible]

[1] Address given before the Souther[illegible] [illegible] and Industry meeting in Atlan[illegible] 1942.

[illegible]ution to the progress of the South, and so direct [illegible]the relation of industry to our whole economic struc[illegible]re that it is particularly promising that science and [illegible]dustry propose to join hands in this effort. We [illegible]ave no thought that science and industry hold the [illegible]emedies for all our ills, but we believe that the situa[illegible]ion which prevails in the South to-day is such that [illegible]he combined resources of science and industry, concentrated upon the natural resources of the South, can contribute tremendously to its progress.

Since this organization is committed to the application of scientific research to the development of the South and the solution of its problems it would not be out of place to suggest some considerations which seem to be of fundamental importance in our efforts to build for scientific research and its application to the building of the South.

My first suggestion is that our program should be one of *activity,* and not one of mere deliberation. It would seem that southerners have long ago been sufficiently informed with reference to the position of the South in the scale of progress. The South has been told that it is noted for its illiteracy, poverty and backwardness; that its intellectual resources, as well as its soil, have long since been drained to depletion; that it is a fertile field of activity for the political demagogue; that it is the nation's number one economic problem; and other such characterizations, until, no matter how true, there would seem to be little value in continuing to repeat them. No one is more conscious of the shortcomings of the South than are those southerners who are capable of understanding, and those who are not capable of understanding are likely to profit little by the repeated recitation of discouraging facts. For its improvement the South needs a program of activity such as the business man, the industrialist and the scientist can offer, provided they care to combine their efforts to that end. It seems probable that little will be gained by continued talk about the South, but a great opportunity exists for any organization which will go actively and quietly about the job of promoting constructive scientific research in the problems of the South.

It is apparent that many of the difficulties under which we labor in the South are directly related to our low regional income. As was pointed out by Odum in his "Southern Regions of the United States," the South does not have its share of the total wealth of the nation, millionaires are entirely too scarce in this area, and per capita incomes are the lowest in the nation. Many of our leaders in the fields of the social sciences are convinced that the one way out for the South is through the greater regional wealth which [illegible]n best be attained through industrialization.

[illegible] industries are to devel[illegible] natural re- show how they may be developed. This responsibilit[illegible] upon science is a great one and one which will inev[illegible]tably loom large in the minds of those who view t[illegible] situation. We must not, however, focus our attentio[illegible] so directly upon that need as to lose sight of othe[illegible] considerations. If we attempt to move too directl[illegible] and too rapidly toward industrial research and indus[illegible]trialization it seems probable that not only shall indu[illegible]trial research soon find itself barren and ineffec[illegible] but we shall fail in our larger motive of creating [illegible] healthier, happier and more prosperous South.

If the South is to move forward, and certainly [illegible] scientific research is to progress, the general pu[illegible] in the South must become more scientifically-min[illegible] and the methods of science must be more commo[illegible] followed in the attempt to solve our proble[illegible] Thomas Cary Johnson, in his "Scientific Interest[illegible] the Old South," takes the position that the "[illegible] South" was very much the same in its attitude towa[illegible] science as other sections of the country. Despite [illegible] that might be said, however, for its interest in nat[illegible] history, for the popularity of so-called science cour[illegible] in its colleges, and for the great scientists who [illegible] have come out of the South, the primary motive [illegible] the old South seems to have been that of broad, general culture; and at no period in its history could t[illegible] South be regarded as dominated by the spiri[illegible] science. The tendency of the modern South too o[illegible] is that of substituting verbal homage to the achi[illegible]ments of science for real support of productive e[illegible] in that field and, even then, science is commonly [illegible]stricted to the gadgets which technology has prod[illegible] to make life more comfortable.

It is an oft-repeated statement by scientists that [illegible] greatest thing in science is its method. The full m[illegible]ing of this statement is not always comprehended [illegible] few follow this method in all their activities. [illegible] to scientists themselves it is often more of an [illegible] than a method which is always followed. The st[illegible]ment has meaning, nevertheless, and it is a met[illegible] which is just as applicable and just as essenti[illegible] arriving at the truth in matters of social policy a[illegible] matters of special scientific research. This meth[illegible] demands that judgments be based upon facts and [illegible] judgments, therefore, be withheld until the facts [illegible] obt[illegible] demands freedom. In it there must [illegible] no clos[illegible] or inform[illegible] which must be wi[illegible]held for the sake of policy or expediency. Its foun[illegible]tion stones are diligence in the quest for facts, hone[illegible] and objectivity. It can not countenance dishone[illegible] d[illegible]t, personal bias or looseness. It must be char[illegible]terized by freedom to move into new frontiers [illegible] freedom to abandon ideas which experiment [illegible] proved to be untenable.

No human society embodies fully the sci[illegible] method, but it is doubtless true that those [illegible]

which have embodied this method most fully are the ones that have attained the most perfect social organization. It seems unlikely that the South or any other region will ever achieve its greatest development until it is willing to abandon personal and social bias, and an unwillingness to face facts and to substitute reason for prejudice as a basis for decision and scientific method for political chicanery in public affairs. Certain it is that scientific research, pure or applied, can never progress much beyond its present state in the South until it has the support of a public which has something of the scientific spirit and method and an understanding of the achievements which its method makes possible.

The task of implanting the aim, the spirit and the method of science in the minds and the activities of the public is one of the important tasks which science and industry must face. It is one of education and one which can not be accomplished in a day. The prevailing traditions of the South which have so commonly ignored science are firmly fixed, and this task will require the greatest patience, skill and perseverance. In this task a great responsibility rests upon science in the understanding and sympathy which must characterize its efforts. Those who are devoted to the traditions of a classical culture dread the approach of science and technology because these seem to threaten the values which they have cherished. Scientists and technologists must accept a large responsibility for this fear because they have so often interpreted science with apparent disregard for human values. If the scientist hopes to be a factor in building a greater South he must never cease to recognize his obligation to the public which supports his efforts—the public which must understand him.

I have dwelt upon this question because I am convinced that, despite the practical importance which the devastation of the Civil War, the collapse of the "Cotton Kingdom" and other misfortunes may have had, the fundamental basis for the present economic and social plight of the South is to be found in large part in the southern attitude of mind, and that herein lies one of the primary tasks which science must face.

Our educational system, and particularly higher education, bears an essential relation to the development of scientific research in southern problems. For inventions and for ideas capable of direct application industry will probably turn primarily to groups of specialized research workers with whom their contacts are intimate. These groups may be located in educational institutions, but in most instances they will probably be in industrial laboratories or in institutes devoted to applied research. In order that the South may reap the greatest benefits from its natural resources it is necessary not only that the industries be located in the South but also that the r... relative to those resources be carried on in the ... Furthermore, it stands to reason that the resour... the South can be best developed by those who ... the South and who know those resources through contact with them.

If institutes of applied research and the indu... which look to them are to function adequately, ... practically imperative that they be backed up b... strong system of higher education which places ... phasis upon scientific research and which brings students into an acquaintance with the problems a... the resources of this region. The workers in labor... tories of applied research must necessarily be fu... nished from the science departments of colleges an... universities and it is natural to expect that a majo... ity of these should, for southern enterprises, com... from southern institutions. For this reason emphasis must be placed upon the need for a strong educational system and the essential position of higher education.

The sort of scientific training which our students must have can not be provided by second-rate institutions, and it has been repeatedly shown that we ha... relatively few institutions in the South which coul... by any stretch of imagination, be regarded as approaching the status of first-rate universities. In the past, southern colleges and universities have been ver... effective in the general culture which they imparte..., in their training for certain non-scientific professions such as law and theology and in the quality of students which they have sent into other regions. It is doubtful, however, whether there is a single institution in the South that is giving adequate attention and support to the sciences to enable them to meet their responsibility in the development of the re... sources of the South and the solution of its problems.

Few people actually realize how expensive graduate work and research in the sciences must inevitably be. In attempting to build for research we must fac... this fact; for, if we build graduate schools only to th... level of mediocrity, we shall have accomplished prac... tically nothing. Both cost and expediency will de... mand that we attempt to build neither too rapid... nor too widely, but first-rate universities in the Sou... must come, and the cost, even for the South, is ... prohibitive.

Many practical problems face us in this attem... We must be able to attract and to hold able resea... scholars. The oft-quoted findings of Wilson Gee ... years ago are still substantially true. The South co... tinues to lose to other regions considerably more th... it gains from them in research ability. But this is ... the only menace to research in the South. In ... southern institutions there is too great a tendency ... draw capable research men into ad... ...

…ch. If we are to promote research, too great …asis must not be placed upon administrative posi… while too little emphasis is placed upon the …vities for which the institution in reality exists. …inguished service in the form of productive work … inspiring teaching must not be allowed to go …ecognized, but recognition must not consist in mov… the able investigator or teacher out of his most …ective realm and into administrative circles.

My object in these remarks has been that of point…g out a few of the more general problems which …ght not receive their just consideration if we hasten … focus our attention too directly and exclusively …pon the application of research. I have chosen this …ourse with full knowledge that I could say nothing …ew or particularly interesting. As regards the work of this association I am strongly convinced that from the beginning our course must be purposeful and our program must be one of activity. It would be my hope that every panel discussion in which we engage may be so thorough and comprehensive as to form a point of departure for some concrete course of …ction. I am strongly convinced, furthermore, that …ne of the most effective contributions which this organization may make to the progress of the South lies in the fostering of the scientific approach to prob…ems of public concern, and that scientific research can do little more than survive in an unscientific atmosphere. If research is to progress it must have the sympathy and support which can come only when the public understands something of its aims, its problems and its possibilities. I am still further convinced that if applied research and industrialization are to make their rightful contribution to the progress of the South they must be built upon a strong educational system. The universities which train men for research constitute the foundation upon which applied research must rest.

It is my sincere belief that if this association can enlist the interest and the cooperative effort of leading scientists and industrialists in this region it may become the greatest single force in the economic and social development of the South. This organizati… should assume the function of keeping its han… … the pulse of the South and of giving directi… … scientific and industrial development throug… the utilization of its resources. The extent to which this association succeeds in assisting in the building of the South through research will depend upon the extent to which the scientific principles of diligence in the search of facts, objectivity, open-mindedness and integrity characterize our methods. Should its efforts cease to be strictly scientific and tend to become promotional in character it will undoubtedly fail.

COLLECTIVE FARMING IN RUSSIA AND THE UKRAINE. II

By Sir JOHN RUSSELL, F.R.S.

DIRECTOR OF ROTHAMSTED EXPERIMENTAL STATION

THE results of the recent farming efforts in Russia up to the end of 1938 when the last official figures were issued have been: (1) an increase in numbers of livestock so that they had nearly reached the high levels of 1929, pigs indeed had exceeded all previous records; (2) an increase in the area of cultivated land, which fully kept pace with the increase in population; (3) …arked increases in the area of fodder and of techni…l crops; (4) a smaller increase in area of grain crops …hich represented three quarters of the whole sown …ea. The yield of cereals per acre is still dependent …rgely on the season and it is not certain that any …crease has occurred; comparison is rendered difficult … a change in 1933 in the method of estimating the …eld; American authorities consider that the new …ethod gives estimates about 5 per cent. higher than …e old one for one and the same crop.

The grain results for the U.S.S.R. are given in …ble VIII.

TABLE VIII

OUTPUT OF GRAIN, U.S.S.R.

	Population, millions	Total area sown, million ha.	Cereals sown, million ha.	Cereals produced, million tons	Yield quintals per ha.
1913	134	105	94.4	78.8	8.49
1934		131	104.7	88.0	8.54
1935		132.8	103.4	88.7	8.71
1936		133.8	102.4	81.4	8.08
1937	169	135.3	104.4	1[illegible].1	11.52
1938		136.9	102.4	93.5	9.28
Increase per cent.	27	30.4	8.5	18	

1 q. per ha. = 0.8 cwt. per acre. Biological estimates introduced in 1933. Average yield of wheat in England and Wales 18 cwt., and of oats and barley 10 cwt. per acre.

…hemselves lack picturesque attrac…ness; usually they are built along a road or sometimes round an open space, but it is always an earth road with no side walk, very muddy in wet weather and very dusty in dry. The cottages are small and very simple made of local materials, wood in the north, wood or whitewashed adobe in the center and the Ukraine

thatched with straw or roofed with wood or sheet iron, painted red but soon becoming reddish brown. Iron is safer from fire. In the north there is an attic or garret; elsewhere the cottages have one story only. Usually there are two rooms and a kind of entrance or large lobby, beds in each room, one room has the brick stove, in the lobby there is a cooking stove, but in the south this is often outside, it is then made of clay. Beyond a table and a few seats there is little furniture, though there may be a kind of dresser or cabinet containing some china. In the Ukraine there may be a trunk holding some of the old peasant embroidered work and shown by the old lady with great and justifiable pride. Usually an ikon hangs in a corner, which, it is explained, is for the old [illegible] there may be a portrait of Stalin for the [illegible] r ones; a few faded personal photographs may [illegible] e the adornment. Lighting at night is some- [illegible] difficulty when shortage of fats and oil have [illegible] d supplies of candles and lamps; a pine [illegible] may then be used. But many villages have [illegible] light. Usually there is no sanitation. Water is drawn from a communal well operated by a wheel and bucket; naturally this becomes a center of life and gossip. Elsewhere the cottage has its own well with a long pole as lever to lift up the bucket. In summer there are many flies, though a vigorous campaign is organized against them and on the clinics you may see a scarlet banner with the slogan, "Keep away flies: they cause decay and disease," or another, "Keep clean and so prevent disease." There are mosquitoes and various domestic insects. When you have seen a peasant woman combing a girl's hair you appreciate the force of Postyschev's demand that "hygienic baths and hairdressing shops in the villages must occupy an important part in our Party organization." Naturally one hears of dysentery, enteric, malaria and, at times, typhus, besides stomach troubles. Where there is a local hospital the doctor, often a woman, is kept very busy. The very young children often look sickly; those that grow up, however, look well and in summer they get much sunshine. There are lots of them, very friendly and accessible, very fond of being photographed. The government encourages large families and gives a bonus of 2,000 rubles for the seventh child. But it is only in the country you see them; the town dwellers, like our own, usually have small families.

The women commonly wear a dark skirt and white blouse with a white cotton square tied round the head, but the younger ones wear a printed cotton frock and a printed or embroidered square tied at the back of the head. The embroidered peasant frocks and saraphans of the old days are out of use and deemed old-fashioned. The men commonly wear tunics, trousers and peaked caps; some are bare-footed, some wear bast shoes, others canvas or leather shoes; the smart young men in the Ukraine wear white tunics with embroidered edge and the high Russian boots. All clothing, however, is of very poor quality; the clothes of my English friends were always stared at with great curiosity. One sees few old people either in villages or towns; Russia always impresses the Western visitor as a land of young people. The survival rate after 50 is not as high as in the west.

Each house is in its own piece of land, separated by a rough palisade from the road. Outside the house is the pile of fuel; always local material, it may be peat but is often straw briquettes. One sees but few flowers, although the Russians like them; there are vegetables, however, potatoes, cabbages, tomatoes and little cucumbers; these one finds and eats everywhere, and often the big watermelons. There are also poultry, one or two pigs and the cow, but usually no dog and no cat; you can travel far in Russia and meet few of either. The peasant's dietary is simple, mainly black bread, millet porridge (Kasha) and the vegetable soup known as "shchi"—made with much cabbage, some onions and other vegetables; or "borshch" made with beetroot. Sunflower oil supplies the fat, but some pork is eaten; sometimes you see tinned meat or, on the Volga, dried fish. Tomatoes and little cucumbers are much liked. Apples are the only fruit one sees as a rule; they are widely grown but not usually well grown; there is, however, good research on this subject. In the communal kitchen one often meets a compote made of fruit pulp. Tea and coffee are too dear for common use; on the Volga hot water with a piece of apple in it is often drunk. As alcoholic drink there is kvass, made from fermented black bread and when well made something like fortified ginger beer, and the universal vodka—a very potent spirit of which a good deal is consumed. One notices this in the provincial towns at night.

The administrative center of the village is the chairman's office, usually the cottage of a former kulak, built of brick and somewhat pretentiously decorated. Here one is taken on arrival at the village. Of course you can not wander about in Russia as we do here; the visit has to be arranged well beforehand, no local official can give the necessary authority and higher officials are not easily accessible. In consequence of this difficulty I could not in 1939 obtain permission to visit any grain farm in the Volga region. In the office the president and some of the committee receive us; the book-keeper is there with his abacus. On the walls are the portrait of Stalin, a print or some chart likely to interest or stimulate the village; it may be the list of yields or a diagram illustrating the different rates of work; a slow brigade represented by

a tortoise, the better brigades represented in ascending order by a donkey, a bicycle, a train, an autobus and an aeroplane. Something of the old kulak's possessions may remain; a walnut clock of Victorian design but long since stopped; a very poor picture; I have even seen a book left by the former owner, the German manager of the estate; it was a Brokhaus Lexicon, with pictures on the inside cover drawn by his children —all long since "liquidated" like himself.

Another communal building is the club-house, for the Russians are very sociable and gregarious; here there may be a library, a radio set and a gramophone. The Russians dearly love these; there are scarlet slogans advising you to listen in. The loudspeaker works almost incessantly on the Volga steamer, in the long distance trains, in the city parks and elsewhere; noise never disturbs a Russian. The accordion and balalaika still survive. Then, too, there are facilities for lectures; these in summer afternoons are in the open air, and the lecturer is sent down by the Party. There is no complication about conflicting points of view; only one Party and only one point of view. In going round an exhibition in Moscow with a few friends, one of them, a distinguished student of Russian history, was giving us some explanations in a very quiet voice, but was at once stopped by the attendant; only the official guide could explain. The Russian is eminently teachable and has great respect for teachers and especially for professors: in the villages I am always introduced as an English scientist, a specialist in soils, whose books are used in the Russian agricultural institutes; then comes the question, "Has he written anything about collective farming?" Technical books are very widely read in Russia.

The Soviet Government has done a great deal for the development of education both of children and of adults. For the small children there is always the crèche, in charge of a very kindly looking peasant woman. From 8 to 15 they go to the so-called seven-year school of which every village usually has one, or at least access to one, though the buildings may be as yet inadequate. There may be only three classrooms, one quite small. At first the instruction in the schools was related to the local industry, but that is now altered and the schools are on a uniform type of curriculum which is "cultural" not vocational. In the towns the "ten-year" school is now the standard. By 1939 the educational ladder was pretty complete and a bright child had a good chance of getting to the university; this was very different from 1930 or earlier, when only the Party ticket or proletarian birth would admit. I have known young people who could certainly have taken full advantage of a university education and knew it, but were refused; they remained always disappointed and with a bitter sense of frustration. Even by 1937 ability counted for more than birth or politics and by 1939 the change was complete. The universities were overflowing; one of the professors told me that the total number of students in the Russian universities was above 600,000, and that at the larger universities of Moscow and Leningrad there were ten applications for every vacancy. Many study science and engineering, others, especially women, study medicine or wish to become teachers. German, French and English are widely taught, yet it is most unusual to find any young people who can speak a word of any of these languages, in marked contrast with the older people of culture, many of whom spoke one or more of them with ease; the women often spoke French and the men German. I have often met German-speaking peasants, descendants of German ' ᐧᐧᐧni-grants of bygone days who, as long as they kep old religion, kept their Biblical German la But all that is now going and only the few sp guides and translators can, as a rule, speak a guage but their own. I asked some of my uni friends why this was and received the reply: "Ou. education is cultural, not practical."

On the technical side the immense leeway is being made up. It is hard for us to realize what a colossal task this has been. In the old days Russian workmanship was proverbially bad. It is still often stated that the Russian is a poor mechanic, that maintenance of machinery and buildings is inadequate, that tractors and motors are not properly cared for and that many of the tractors are out of commission. But one must remember the enormous difficulties. Very few of the present generation had, as children, any mechanical toys, apart from some very ingenious wooden toys made by the peasants. Very few even now possess a bicycle, in many villages you see none and I remember once being kept waiting some ten minutes while a bicycle was fetched to show that this village really had one. There are official cars, but hardly any private cars or motor cycles and few taxis, no visible garages, nowhere where a boy can grow into the idea of machinery. In the hills of Georgia I have even met a man who assured me that until he was 21 he had never seen a wheel. Even now, children's mechanical toys are scarce and dear; there are, of course, no cheap 6d. stores, and a very poor toy may cost 3 to 12 rubles. But there has undoubtedly been an advance; the number of tractors has steadily increased to well over a half a million and there are now many tractor drivers, some 25 per cent. being women. The Red Army has been a great educational force and has presumably trained large numbers of engineers and mechanics.

The only large building in the village is the church, often a brick building in the Byzantine style, now usually converted into a club or a grain store or

partly pulled down for its bricks. It is surprising that the Russian peasant, who is always described in pre-Revolution literature as whole-heartedly religious, should apparently have dropped his religion so completely. I talked once about this with a peasant girl who had been through the famine of 1921 and seen her family die, one after the other: first the baby, then the other children and the father, then the mother and finally she herself had laid down to die but was found by a rescue party. "If you had known," she said, "how much we prayed to the saints to help us and give us food and how terrible it was when they did nothing, then you would understand why we no longer believe in them." The young Russian intellectual, of course, had always been an atheist and claimed that science had displaced religion—visitors to the Tretyakovski Collection at Moscow will remember the ribald pictures of the village priests by Perov in the 1870's. It was the intellectual who furnished the ideas adopted after the Revolution. One meets many of these people at the universities and elsewhere; their attitude is always that religion is an antiquated, rather ridiculous superstition, not accepted by enlightened people, and the Russian desire to be counted among these is such that the argument carries great weight. To my question, "If a teacher had religious convictions would he be dismissed?" the answer was "No, not if he were otherwise suitable but we should try to teach him better." This combination of ridicule and lure of "culture" (in the Russian sense) has been much more effective than persecution in the struggle against the church. Religion still survives in Russia; the ikons remain in many of the cottages, there are still churches functioning and people attending the services. Funerals may be either "white" (religious) or "red" (political) and one sees a fair proportion of "whites." I was told, though do not know personally, that many marriages are now not simply civil but religious as well. And there is a Baptist movement both in Poland and in Russia, the depth and significance of which can not be estimated. The Russian must venerate something. Watching the long queue standing for hours in the heat and the glare as they wait to pass through the Lenin tomb in the Red Square at Moscow, one gets the impression of something more than respect for a dead political leader. But it is useless to speculate about the Russian peasant—as Turgenev says: "He is like a mysterious unknown: who knows him? He does not even know himself." There is, however, no doubt about the change in moral standards. Immediately after the Revolution there was a so-called liberation from the fetters of convention that led to considerable license. Lenin strongly opposed this and the new system was found to be pernicious and unworkable. The revolt against it came from the women and gathered force as the love of spórt began to develop; football, volleyball, swimming, above all, parachuting—but not yet cricket or golf. There is perhaps no better tribute to Christian morality than the fact that the Russians have come to it not out of any acceptance of Christianity but because anything else did not answer in practice.

Children no longer receive religious instruction, but they are taught to do good work and to lead moral lives. Keen young people devote their spare time to the training of the children, so that the future may be happier than the past. And the most intense patriotism is drilled into them. Stalin's stirring invocation still holds them: "The supreme law of life" for the citizen "is to love his native soil, language and people; to extol the talents, abilities and achievements of himself and his fellow citizens; to hate and reject all that does not make for the greatness of the Soviet Union, the fatherland of fatherlands."

One of the modern popular songs I heard in 1939 proclaimed that "My country is rich and large; it has fields and woods and beautiful cities, but its chief riches are its people, more free and happy than anywhere else." It is in this faith that the young Russians have been brought up and this, combined with the peasant's deeply rooted and almost fanatical attachment to the land, accounts for the superb resistance they are now putting up.

It is probably true that this war would never have arisen had there been in 1939 the same cooperation between Russia and Great Britain as exists to-day. It seems certain that the future peace of the world depends on a continuance of such friendly relations as will ensure similar cooperation whenever peace may be threatened. But friendly relations are possible only on a basis of mutual understanding and respect. We shall always differ in many ways from the Russians in our outlook and mode of life, and nothing is gained by slurring over the differences or pretending that our points of view are the same. Without giving way on any principles which we hold dear we can find much in common with the best of the Russians. Their history has been one long pageant of suffering, yet through it all has shone an intense feeling for humanity, a desire for a better and happier life for those who come after us. It is vividly shown in their literature, in Tolstoi, in Dostoevsky, in Chekhov, in Gogol—even though some of their writings emphasize the gloomy depths of the Russian character just as their ballet reveals something of its dazzling heights. "How much anxiety," says Tolstoi, "how much suffering we go through before happiness is our return!" And it constantly comes out in daily life in Russia: "Things have been bad for me," a workman once told me, "but I don't mind; they will be better for my children."

The picture of Russia I always like to remember is that of my friend Sonia among the children trying to ensure that their lives may be happier than hers has been. There surely we have a solid foundation on which fruitful Anglo-Russian friendship can be founded.

SCIENTIFIC EVENTS

DEATHS AND MEMORIALS

HENRY GRANGER KNIGHT, since 1927 chief of the Bureau of Chemistry and Soils of the U. S. Department of Agriculture, died on July 13, at the age of sixty-three years.

CAPTAIN WILLIAM JOHN PETERS, formerly chief magnetic observer of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, died on January 10, at the age of seventy-nine years.

HENRY GERBER REIST, who retired as chief of the alternating current engineering department of the General Electric Company in 1930, died on July 5. He was eighty years old.

DR. DAVID WILLIAM CORNELIUS, professor of physics at the University of Chattanooga, Tennessee, died on June 2, at the age of fifty-seven years.

DR. WILLIAM MCCULLY JAMES, for twenty-six years chief of the Hospital of Panama and of the Herrick Clinic, died on July 10, aged sixty-two years.

CHARLES CARMICHAEL ARTHUR MONRO, assistant keeper in charge of Annelids in the zoological department of the British Museum (Natural History), died on June 21.

ACCORDING to *Nature*, it has been announced that among the Czechoslovak patriots recently executed by the Germans are a university dean and two professors, several secondary schoolmasters and a number of young men described as university students, although the universities have been closed for nearly two years. One of the professors was Professor Jaromir Šamal, formerly professor of entomology in the Prague College of Agriculture, whose work had considerable local importance through his books in Czech on the anatomy and life-history of insects, on their ecology and their economic importance. Dr. Šamal was forty-one years of age.

THE *Journal* of the American Medical Association reports that an annual W. J. and C. H. Mayo Memorial Lectureship in the field of medicine and surgery has been established at the Medical School of Dartmouth College, by Dr. and Mrs. Waltman Walters, Rochester, Minn. The memorial is established as "a stimulating factor in interesting men in medicine and surgery; particularly to call attention to the accomplishments of Drs. W. J. and C. H. Mayo in these fields."

AWARDS OF THE SOCIAL SCIENCE RESEARCH COUNCIL

SIXTY-FIVE awards, amounting to $77,700, for the academic year 1942–43, have been announced by the Social Science Research Council. The awards provide for study and research in the fields of economics; political science; sociology; statistics; political, social and economic history; cultural anthropology; social psychology; geography and related disciplines.

Ten of the awards, carrying a basic stipend of from $1,800 to $2,500 for twelve months, plus travel allowance, cover post-doctoral research training fellowships to men and women under thirty-five years of age who possess the Ph.D. degree or its equivalent. These fellowships are granted for the purpose of enlarging the research training and equipment of promising young students in social science through advanced study and field experience.

Fifteen appointments are pre-doctoral field fellowships which carry a basic stipend of $1,800 for twelve months plus travel allowance. The recipients are graduate students under thirty years of age who have completed all the requirements for the doctorate except the thesis. The purpose of these awards is to supplement formal graduate study by opportunities for field work which will assure first-hand familiarity with the data of social science in the making.

The remaining forty awards are research grants-in-aid designed to assist mature scholars in the completion of research already well under way. These grants average about $400 and do not ordinarily exceed $1,000. Nine of these appointments were made through a special fund specifically granted for the purpose of assisting and encouraging the research of social science faculties in the South. The objectives and requirements for eligibility are the same as those governing the national grants-in-aid, but applications are restricted to fourteen southern states.

RETIREMENTS AND APPOINTMENTS AT THE AMERICAN MUSEUM OF NATURAL HISTORY

A REORGANIZATION of departmental classifications in the American Museum of Natural History, with the retirement of four members of the scientific staff, was announced on July 16 by A. Perry Osborn, act-

ing president of the museum and chairman of the management board.

The retiring members are Dr. Clark Wissler, curator of anthropology; Dr. Frank M. Chapman, curator of birds; Dr. Barnum Brown, curator of vertebrate paleontology, and Dr. Willard G. Van Name, associate curator of living invertebrates. Each will continue his work with the title emeritus.

Dr. Wissler joined the staff in 1902 and was appointed curator of anthropology in 1907. Over a period of thirty years his first-hand study of Indian tribes in the western United States, particularly the Sioux, Blackfeet and Gros Ventres, has resulted in many scientific and popular publications. Under his direction the anthropological exhibitions have expanded through four floors of the museum building to include not only a collection of North American Indian materials, but also the relics of Mayan, Aztec and Inca civilizations, the artifacts of prehistoric man, and existing primitive peoples in many parts of the world. Since 1937 Dr. Wissler has served as dean of the scientific staff and has also been professor of anthropology in the Institute of Human Relations at Yale University. Dr. Harry L. Shapiro, associate curator of physical anthropology, has been appointed chairman of the department of anthropology to succeed Dr. Wissler.

When Dr. Chapman went to the museum fifty-four years ago, the bird collection consisted of only several hundred specimens, most of them on exhibition and very few available for purposes of study. Scientific expeditions were unheard of, except for those made by staff members in local areas. Through his leadership, the study collections of the Department of Birds have been increased in number to more than 750,000 specimens. The first attempt in any museum to show birds in life-like habitat settings was made by Dr. Chapman with the creation of the Cobbs Island Bird Group, at the beginning of the century. Perhaps even more important is the part he has played in awakening sentiment for the protection of wild bird life. He will continue research and exhibition work in the museum and plans to celebrate the fiftieth anniversary of the publication of his "Handbook of Birds of Eastern North America" with a new edition in 1945. Dr. Robert Cushman Murphy, formerly curator of oceanic birds, has been appointed chairman of the Department of Birds; and Dr. John T. Zimmer, formerly executive curator, becomes curator of that department.

The name of Barnum Brown is almost synonymous with those of the giant prehistoric reptiles, such as Tyrannosaurus Rex, Brontosaurus, Allosaurus and hundreds of other dinosaurs which he has recovered from burial grounds millions of years old. Excavated from the rock beds of North and South America, Asia, Africa and Europe, the bones of these fossils have been recreated in the dinosaur halls, the most complete collection of its kind in the world. Dr. Brown has led some thirty expeditions since he went to the museum in 1897. The greater part of these explorations have been in the United States and Canada and from the fossil beds of Alberta, Wyoming, Montana, Colorado, Utah, to the southern borders of Texas. With his retirement, the department of paleontology is divided into three sections. Fossil reptiles will be incorporated in the department of amphibians and reptiles, with Dr. Edwin H. Colbert as chairman and acting curator of fossil reptiles, and Dr. Charles M. Bogert as acting curator of recent amphibians and reptiles. The division of fossil mammals, with Dr. George Gaylord Simpson as curator, has been made part of the department of mammals, of which Dr. Harold E. Anthony is the chairman and curator of recent mammals. Dr. Harold E. Vokes, formerly assistant curator of fossil invertebrates, has been appointed associate curator of this branch within the department of invertebrates, headed by Dr. Roy W. Miner, chairman and curator of living invertebrates.

Dr. Willard G. Van Name, a member of the department of invertebrates since 1917, has specialized in the research of marine life, especially in the Pacific. In expeditions along the coast of California, in the Philippines and other parts of the East Indies he has made valuable collections of small sea-life. Since 1927 he has been a member of the trustees committee on conservation. His forthcoming writings will include a monograph on his extensive research of the American ascidians.

THE YALE UNIT, U. S. MILITARY HOSPITAL

The Yale Unit, U. S. Military Hospital No. 39, including 48 physicians, 7 dentists, 103 nurses and civilian specialists, was mobilized by the U. S. Army for active war duty on July 15. The hospital unit is designed to accommodate 1,000 patients in a theater of military operations. It is a stationary hospital in the rear of a combat zone and probably will be used for foreign service. It is much larger than Mobile Hospital No. 39, which was organized by Yale in World War I, which was the first American hospital unit to land in France. This earlier surgical unit played an important role during the St. Mihiel offensive.

A message has been sent to the unit from President Charles Seymour of Yale and officials of the Yale School of Medicine, School of Nursing and the New Haven Hospital. It is as follows:

As you leave for active duty, we are anxious to extend

to you, on behalf of Yale and the New Haven community, our warm good wishes and our deep appreciation of the service which you are giving to the nation.

University and town are consecrated to that service and all our traditions demand that it should be carried on in whatever field it can be made effective. There is no field more important than that which you enter, where you will bring to the armed forces in the hour of need the science and the art of doctor and nurse. We are proud that through you Yale and the New Haven Hospital have the privilege of serving the American people.

The greeting is sent to the unit "with affection and respect" and is signed by President Seymour; Dean Francis G. Blake, of the School of Medicine; Dean Effie J. Taylor, of the School of Nursing; Harry C. Knight, of New Haven, president of the General Hospital Society of Connecticut; Thomas W. Farnam, chairman of the executive committee of the New Haven Hospital, and James A. Hamilton, director of the New Haven Hospital.

U. S. Military Hospital No. 39 will now undergo a period of training in military hospital techniques in the United States prior to engaging on actual field service. The present staff will be supplemented by 500 enlisted men, some of whom will be drawn from the New Haven area.

The bulk of the nursing personnel are either graduates from or members of the faculty of the Yale School of Nursing, or are present or former members of the New Haven Hospital nursing staff. Thirty are graduates of the Yale School of Nursing. All members of the medical personnel hold positions on the faculty of the Yale School of Medicine and the New Haven Hospital. Of this group 26 doctors are already on active duty in various Army hospitals and joined the unit at the point of mobilization. The commanding officer of the unit will be a colonel of the Army Medical Corps, designated by the War Department.

Dr. James C. Fox, Jr., clinical professor of neurology at the Yale School of Medicine, has been acting as director of the unit for the past two years during its period of organization. He now becomes chief of the medical service with the rank of lieutenant colonel. Dr. Ashley W. Oughterson, associate professor of surgery, will be chief of the surgical service with the rank of lieutenant colonel. Dr. Oughterson has been on active Army service for the past six months at various posts.

SCIENTIFIC NOTES AND NEWS

The degree of doctor *honoris causa* has been conferred by the Catholic University of Chile on Dr. George W. Corner, director of the department of embryology of the Carnegie Institution of Washington.

The Friedenwald Medal of the American Gastro-Enterological Association was presented on June 8 during the Atlantic City meeting to Dr. Max Einhorn, since 1896 professor of medicine at the New York Post-Graduate Medical School, Columbia University, for "outstanding achievements in the field of gastroenterology and for the invention and putting into practical use of many instruments of precision used in the study of digestive diseases."

The Borden Prize, a gold medal and $1,000, of the American Dairy Science Association was presented to Dr. Hugo H. Sommer, professor of dairy industry at the University of Wisconsin, at the recent annual meeting of the association.

An Associated Press dispatch states that Sir Arthur Hope, governor of Madras, decorated Sir Chandrasekhara Venkata Raman on July 16 with the medal of the Franklin Institute, Philadelphia, for "preeminent service in the scientific sphere." Sir Chandrasekhara was unable to go to America to receive the medal in person.

Dr. Richard W. Wilkinson, Washington, on May 20 was presented with the Frank E. Gibson Award at a meeting of the Washington Medical and Surgical Society, for his "original and outstanding paper on ophthalmology." The prize is given in recognition "of meritorious contributions to medical science." It was established in 1937 in honor of Dr. Frank E. Gibson, permanent treasurer of the society.

A. Gouge has been elected president of the British Royal Aeronautical Society for the year 1942–43. E. F. Relf, superintendent of the Aerodynamics Department, National Physical Laboratory, and Dr. H. Roxbee-Cox, deputy director of scientific research at the Ministry of Aircraft Production, have been elected vice-presidents.

The Eastern Section of the Seismological Society of America did not hold its annual meeting this year because of the war situation. A mail ballot was held for the election of officers for the year beginning on July 1, and the following were elected: *Chairman*, Elwyn L. Perry, Williams College; *Vice-chairman*, William A. Lynch, Fordham University; *Secretary*, Florence Robertson, St. Louis University; *Treasurer*, James T. Wilson, University of Michigan; and *Fifth Member of the Executive Committee*, Ralph R. Bodle, U. S. Coast and Geodetic Survey.

At the University of London the title of professor emeritus of anatomy in the university has been con-

ferred on Dr. J. E. S. Frazer, who resigned from the chair of anatomy at St. Mary's Hospital Medical School in March, 1940. The degree of D.Sc. has been conferred on Dr. R. V. Christie, professor of medicine at St. Bartholomew's Hospital Medical College.

DR. OSKAR WINTERSTEINER, formerly professor of biochemistry, College of Physicians and Surgeons, Columbia University, and since 1941 head of the biochemistry department of the Squibb Institute for Medical Research at New Brunswick, N. J., has been appointed honorary professor of biochemistry at Rutgers University.

DR. MARK H. INGRAHAM, since 1932 head of the department of mathematics of the University of Wisconsin, has been appointed dean of the College of Letters and Science.

GEORGE P. REA, whose resignation as president of the New York Curb Exchange became effective on June 30, has been elected president of the Drexel Institute of Technology, Philadelphia. He will take up his new work on August 1.

ACCORDING to a report in the *Times*, London, the trustees of the Lady Tata Memorial Fund announce that, on the recommendation of the Scientific Advisory Committee, they have agreed, if circumstances permit, to make the following awards for research in blood diseases, with special reference to leukemia, in the academic year beginning on October 1, 1942: Grants for research expenses—Professor J. Furth (New York); Dr. P. A. Gorer (London); Dr. A. H. T. Robb-Smith (Oxford); Professor L. Doljanski (Jerusalem); part-time personal grant for assistance, Dr. W. Jacobson (Cambridge).

DR. LON A. HAWKINS, physiologist, who has been connected for thirty-five years with the U. S. Department of Agriculture, has retired as head of the Division of Control Investigations in the Bureau of Entomology and Plant Quarantine. Curtis P. Clausen, in charge of the Division of Foreign Insect Parasite Introduction, will take over the work of the Division of Control Investigations until a successor to Dr. Hawkins is appointed.

DR. ERNEST LYMAN STEBBINS, since 1940 professor of epidemiology at the College of Physicians and Surgeons of Columbia University, who for two years previously served as Assistant Commissioner of Health of the City of New York, has been appointed to succeed Dr. John L. Rice, Commissioner of Health, who recently resigned for reasons of health. Dr. Rice will serve as special consultant to the Department of Health.

DR. LOUIS B. FLEXNER, member of the Department of Embryology of the Carnegie Institution of Washington, has been given leave of absence from the laboratory in Baltimore to serve as aide to the Committee on Aviation Medicine of the National Research Council. Dr. S. R. M. Reynolds is also on leave of absence, having been commissioned First Lieutenant in the Army Air Force and attached to the School of Aviation Medicine at Randolph Field, Texas.

DR. ERNEST M. LIGON, associate professor of psychology at Union College, Schenectady, has been appointed an expert consultant to the Secretary of War. He will lecture to personnel classes at Fort Washington, continuing his research work at Union College.

DR. J. EDWARD TODD has been appointed assistant to Harry F. Lewis, dean of the Institute of Paper Chemistry. From 1928 to 1937 he was director of admissions, secretary of personnel service and assistant professor of psychology and education at Carleton College. From 1937 to 1941, he occupied similar positions at Springfield College.

DR. HARRY E. KLEINSCHMIDT, of New York, has resigned as a member of the staff of the National Tuberculosis Association, effective at the end of the summer. He has been since 1929 director of health education.

DR. ELLIOTT CARR CUTLER, Moseley professor of surgery at the Harvard Medical School and chief surgeon at the Peter Bent Brigham Hospital, Boston, has returned to active duty with the U. S. Army after an interval of twenty-three years.

ACCORDING to the *Journal* of the American Medical Association, two members of the Subcommittee on Industrial Health and Medicine of the Health and Medical Committee—Dr. W. C. Sawyer and W. P. Yant—are now in Great Britain as representatives of the United States Government to study the industrial hygiene program in British war industries. Dr. Sawyer is a new member of the subcommittee, replacing Dr. Lloyd M. Noland, who recently resigned.

DR. EVAN CLIFFORD WILLIAMS, director of research and vice-president of the Shell Development Company, California, and for the last year vice-president and director of research of General Mills, Inc., Minneapolis, has been appointed chemical director and vice-president of the General Aniline and Film Corporation, New York, N. Y., and has been elected a member of the board of directors. From 1923 to 1928 Dr. Williams was Ramsay Memorial professor of chemical engineering at the University of London.

THE eighty-fourth annual meeting of the American Dental Association, planned to be held in Boston at the end of August, has been postponed for the dura-

tion of the war. The house delegates, standing committees and board of trustees will meet in St. Louis to transact the essential business of the association.

ANNOUNCEMENT is made by the Chicago Section of the American Chemical Society of a change in dates and location for its second National Chemical Exposition, owing to the acquisition by the United States Army of the Stevens Hotel in Chicago. The exposition and conference have been transferred to the Sherman Hotel, at Clark and Randolph Streets, and will take place from November 24 to 29 instead of a week earlier as originally planned. Adequate space will be available for an exhibit about twice as large as the first exposition sponsored by the Chicago Section in 1940.

THE Geological Society of America was represented at a conference held in Boston, in December, 1941, to consider the advisability of establishing a Commission on the Classification and Nomenclature of Rock Units. The representatives—Carl O. Dunbar, G. Marshall Kay and W. H. Twenhofel—have been continued through the present year to assist in the establishment of the permanent commission. The objects of these conferences are to bring together, under the joint auspices of the Association of American State Geologists, the American Association of Petroleum Geologists, the U. S. Geological Survey, the Geological Survey of Canada and the Geological Society of America, representatives of active American stratigraphers for debate and discussion of principles and current practices in stratigraphic nomenclature.

IT is stated in *Nature* that men of science in Great Britain now have the opportunity of exchanging scientific communications and inquiries with the U.S.S.R. through official channels. A conference was recently called at the Royal Society's rooms to discuss the development of contacts between British and Russian scientific workers. A committee was appointed to examine the possibilities, and its work has been greatly facilitated by the sympathetic attitude of the Embassy of the U.S.S.R. The following procedure has been approved by the bodies concerned. Letters addressed by individual British men of science to individual Russian men of science, or communications from British scientific and technical societies to the corresponding Russian societies, can be forwarded either to Sir John Russell, F.R.S., Ministry of Information, London, or J. G. Crowther, the British Council, London. They will take the necessary steps to forward the communications to the U.S.S.R.

THE loan fund of $5,000,000 voted by Congress to help college students speed up their training for technical and professional jobs will be available soon, according to an announcement made by Paul V. McNutt, chairman of the War Manpower Commission. Monthly loans amounting to not more than $500 a year, at 2½ per cent. interest annually and cancelled if the student is drafted during training, will be made directly to students by colleges or universities and by public or college-connected agencies. Federal funds will be allocated to the loaning institutions by the U. S. Office of Education on the submission of estimates of the amount of money for such loans. Bulletins announcing the program are being sent to all colleges and universities in the United States by the Office of Education. This financial assistance will permit students to pursue intensive programs of study which will prepare them as soon as possible to meet the growing need for technicians. Loans will be made to students in engineering, physics, chemistry, medicine, dentistry, pharmacy and veterinary medicine, who are within two years of completing their work. The program is an outgrowth of recommendations by the Office of Education Wartime Commission which conducted studies of the need of accelerated programs in colleges. Plans for administration of the student loan fund are being developed by Dr. Fred J. Kelly, chief of the Division of Higher Education, Office of Education. They will be submitted by John W. Studebaker, U. S. Commissioner of Education, to Mr. McNutt for approval.

IT is planned to issue a new series of pocket-size books entitled "The Treasury of Science" under the control of a board of editors which now includes among its members Dr. Alvin Johnson, director of the New School for Social Research; Professor Harlow Shapley, director of Harvard College Observatory, and Dr. Alfred E. Cohn, of the Rockefeller Institute for Medical Research. The object is to make available to students and to the reading public the best general statement in each science. The series will be published by the L. B. Fischer Publishing Corporation, New York City.

THE council of the Geological Society of America has approved the preparation of a directory of North American geologists patterned somewhat after the "Internationaler Geologen und Mineralogen Kalender," last printed in 1937. Names are being gathered from the membership lists of the national geological societies. For names of additional geologists it is planned to check the lists which are expected in response to an appeal, distributed with the National Roster questionnaire, for names of graduates majoring in geology since 1932. The directory will contain name, position and address, as well as a list of geo-

logical departments and institutions and their personnel.

A COLLECTION of mollusks, from waters all over the world, has been added to the department of zoology of Field Museum of Natural History. It includes more than 100,000 specimens of shells, accumulated during a period of some forty years by Walter F. Webb, of Rochester, N. Y. The collection was acquired through the interest of Stanley Field, president of the museum. According to Dr. Fritz Haas, curator of lower invertebrates, the permanent scientific value of the collection is enhanced by the fact that it includes other important private collections which Mr. Webb had purchased in Europe and America, some of them dating as far back as the eighteen-sixties.

DISCUSSION

JOINTING IN THE COAL BEDS OF OHIO

THE results obtained from a study of jointing in the coal beds of Ohio are interesting. From data secured by field work and from engineers and operators, some important facts have come to light. The jointing or cleat, as it is commonly known, shows remarkable regularity or uniformity in trend. The joints appear to follow the trend of the Appalachians to the east. The direction of the joints appear to be the same, even though more than one coal bed is involved. In Mahoning, Columbiana, Stark, Tuscarawas, Wayne, Holmes, Belmont, Jefferson, Harrison, Carroll, Guernsey and Noble counties, the joints occur in two sets commonly known as the face and the butt joints. The two systems occur at right angles to each other, one set running in a northeast-southwest direction and the other having a northwest-southeast trend. Farther south in Muskingum, Perry, Hocking, Athens and Morgan counties, one system trends in a direction a few degrees west of north and the other at right angles, has a course running a few degrees north of east or nearly east and west.

There is a variety of opinion as to the origin of the cleat in coal. One group of geologists believe that the cause is inherent in the coal itself, and that jointing is the result of contraction from the loss of gases such as methane and carbon dioxide, moisture, and the rearrangement of the carbon compounds, which has caused loss of substance. The other group are convinced that the cleat is the result of tectonic forces. The writer is inclined to follow the latter group. It is difficult to explain the remarkable uniformity in direction of the joints and the parallelism with the Appalachian folds unless we assume diastrophic movements. Moreover, shrinkage of coal, one would assume, would produce jointing in all directions.

KARL VER STEEG

COLLEGE OF WOOSTER

LABORATORY PSYCHOLOGY AND THE A.B. DEGREE

THE status of laboratory psychology in 75 prominent colleges and universities of the United States has recently been reviewed by Winter.[1] Winter's report dealt especially with the question of whether psychology was or was not included among the group of sciences which satisfy the science requirement for the A.B. degree. Of the 75 institutions listed, 13 (or 17 per cent.) had no laboratory science requirement for the A.B. degree; 18 of the remaining 62 institutions (29 per cent. of the 62) accepted psychology as satisfying the laboratory science requirement for the A.B. degree; 44 of the 62 institutions (71 per cent.) did not accept psychology to satisfy the laboratory science requirement for the A.B. degree.

Subsequent to the initial publication of these figures, a note by Courts[2] disclosed that the University of Missouri, which was classified as not accepting psychology to satisfy the science requirement for the A.B. degree, had changed its policy in 1939–40, and now accepted psychology. In view of the fact that Winter's original data were obtained in 1937, it appeared likely to the present writer that other similar changes might have occurred during the 5-year interim. On the strength of this supposition a questionnaire was sent to the 43 institutions (excepting the University of Missouri) which were originally classified as not including psychology among the sciences which satisfy the requirements for the A.B. degree. Replies were received from 42 of those to which requests were sent—a remarkably high percentage of returns. The results show several changes from the tabulation reported by Winter.

(1) Thirty-six of the 44 remain in the negative category. (We here classify the single non-responding institution along with those which voted negatively.)

(2) Three which formerly did not accept psychology to satisfy the science requirement for the A.B. degree now accept it. These three are, the University of Chicago, the University of Colorado and North Dakota University. With the University of Missouri, a total of 4 which formerly did not accept psychology to satisfy the science requirement now do so.

(3) Four of the original 44 reported special extenuating circumstances, to wit:

(a) The Massachusetts Institute of Technology gives

[1] J. E. Winter, SCIENCE, 95: 96–97, 1942.
[2] F. A. Courts, SCIENCE, 95: 275, 1942.

no A.B. degree, hence should not be listed as "not accepting" psychology to satisfy the science requirement it does not have.

(b) Similarly the University of Florida, although it gives the A.B. degree, has no science requirement in connection with that degree.

(c) At Rutgers and Vanderbilt Universities, the A.B. laboratory sciences are placed in the work of the Junior Division. Psychology is in the Senior Division, where it is accepted as a laboratory science.

These recent changes necessitate corrections in the material published by Winter. The tabulation now stands as follows:

(1) Fifteen of the original 75 institutions have no laboratory requirement for the A.B. degree. (One of these, the Massachusetts Institute of Technology, does not give the A.B. degree.)

(2) Twenty-two of the remaining 60 institutions (37 per cent.) now accept psychology to satisfy the A.B. laboratory science requirement.

(3) Thirty-six of the 60 institutions (60 per cent.) do not accept psychology to satisfy the laboratory science requirement.

(4) Two consider it too advanced for this basic requirement.

The increase from 29 to 37 per cent. acceptance in 5 years may be taken as evidence of a definite trend toward the inclusion of psychology among the laboratory sciences which satisfy the requirements for the A.B. degree.

W. N. KELLOGG

INDIANA UNIVERSITY

AN EXPANDING UNIVERSE AN INDETERMINATE PROBLEM

CERTAIN fundamentally important considerations in connection with this and other problems appear to have been overlooked or neglected in many writings and discussions of questions in ultra remote astronomy.

Nothing can possibly be known or ascertained about an object one hundred million light years distant from the earth, later than conditions as they were one hundred million years ago. It is wholly unwarrantable to assume that no material changes have taken place in that immensely long period of time and that conditions that we *observe* now are the same as those that *exist* at present. In other words, there is a complete absence of any certainty that changes which might entirely invalidate any deductions or conclusions based on this assumption have *not* taken place since the date of the latest available evidence.

For two objects distant, respectively, one hundred million and two hundred million light years from us, in the same region of the sky, we have no basis for considering their relative contemporaneous positions and other conditions except upon an assumption that no relative changes had taken place, up to one hundred million years ago, during the preceding one hundred million years. Such an assumption is manifestly quite untenable, or at least problematical.

The light-year, as the unit of measurement for great astronomical distances, is really *one yearly light mileage*. It might better be designated one Y L M.

The problem of whether the universe is "expanding" *now* or not is something like trying to determine several unknown quantities from a less number of independent equations than the number of values sought. The problem is not solvable: It is indeterminate.

JOHN MILLIS

CLEVELAND, OHIO

NICOTINIC ACID

THE reaction of the public to hastily reviewed or hastily read scientific articles, especially those relating to diets, vitamins or tumor growth, is something that deserves consideration. A good example may be pointed out in regard to nicotinic acid. The only reason for changing its name to "niacin" was because of the unfortunate linking in the lay mind of nicotinic acid and tobacco. In regard to hastily reviewed articles, one news release headlined an article dealing with the fortification of white bread by nicotinic acid—"Tobacco in Your Bread"! The lay response to this article may well be imagined.

The recent work dealing with cancer induced by the feeding of butter-yellow and modifications by specific diets is definitely newsworthy and probably headed for popularized review. I do not believe that any amount of explanation will suffice to separate "butter-yellow" from "butter" in the lay mind, and I therefore would like to enter a suggestion that steps be taken to change the name of "butter-yellow" to a form that does not have such an undesirable connotation.

JAMES R. ENRIGHT

Director, Bureau of Communicable Diseases

HONOLULU, HAWAII

BIOGRAPHY OF THE EARTH

IN my recent popular book, "Biography of the Earth" (Viking Press, 1941), representing an attempt of synthesis of to-day's astronomical, geophysical, geological and paleobiological knowledge concerning the history of our globe, I have used to a large extent the results of Professor Charles Schuchert, of Yale University, on the distribution of waters and lands in past geological epochs. In doing so I was acting under the conviction that the published results of any scientific research become an intrinsic part of science, and can be used freely for the purpose of further study or popularization. Professor Schuchert informs me, however, that in this case the situation is different, since the results collected in his paleogeographical

maps were copyrighted. In view of this fact, I am extremely sorry for having committed a mistake of using Professor Schuchert's interesting and informative results without first consulting him on that matter, and deeply apologize for hurting, though unwillingly, his feelings of ownership in that matter.

G. GAMOW
THE GEORGE WASHINGTON UNIVERSITY

SPECIAL CORRESPONDENCE

FIELD MUSEUM PALEONTOLOGICAL EXPEDITION TO HONDURAS

A PALEONTOLOGICAL expedition of Field Museum of Natural History worked in the Republic of Honduras from early November, 1941, until April, 1942. The personnel consisted of Paul O. McGrew as leader and Albert A. Potter, of the Nebraska State Teachers College, Chadron, Nebraska, as assistant. Señor Eliseo Carabantes was employed during most of the work and various other Honduran assistants were engaged from time to time.

The object of the expedition was to collect fossil mammals. Particular interest in fossils from Honduras arises from the geographic position of that country. Practically nothing is known of fossils from tropical America, and answers to several perplexing paleontological problems might be gained from study of fossils from that region. Data bearing on the accurate dating of the emergence of the Panamanian land bridge, on the dating of the Tehuantepec marine portal, on the still-existing environmental barrier between the two continents of the Western Hemisphere, on the value of homotaxis in correlation between deposits in northern and southern latitudes and on other problems might well be expected.

Three months were spent in the early Pliocene deposits of the Departamento de Gracias. These beds were worked briefly in 1937–38 by an expedition from the University of Chicago and previously reported upon.[1] Here a large collection of the dwarfed horse, *Pliohippus hondurensis*, was obtained. In addition fossils of dog, mastodon, rhinoceros, deer, camel and some reptiles were collected. All forms found were definitely of northern origin.

In the Departamento de Copan a deposit was discovered which produced an interesting and beautifully preserved collection of late Pleistocene mammals. This site was successfully quarried. Among the specimens collected were *Toxodon, Glyptodon* (?) and *Megatherium* as immigrants from South America, and *Equus, Camelops* (?) and *Felis concolor* of North American origin. Of *Megatherium* an essentially complete skeleton was obtained. The *Toxodon* is of particular interest, as it is the most northern occurrence of this group of South American mammals so far recorded. In 1886 Leidy reported a lower molar and a broken incisor from Nicaragua. Temporary conditions made it impossible to complete excavation in this Pleistocene quarry, but it is fervently hoped that in the not-too-distant future work there may be resumed.

Because of the uncertainty of water transportation, practically all the material was stored in Guatemala, where it will probably have to remain until the termination of the war. Consequently, its study and the determination of its bearing on the above-mentioned problems will necessarily be delayed. It may be stated, however, that the Pliocene fauna supports the conclusions previously reported and that the Pleistocene fauna should throw new light on our problems.

Sincere thanks are due to the government and people of Honduras, who cooperated in every possible way to make the expedition a success.

PAUL O. MCGREW
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[1] E. C. Olson and P. O. McGrew, *Bull. G.S.A.*, 52: 1219–1244, 1941.

QUOTATIONS

SOME SIGNIFICANT FINDINGS OF THE EXPERIMENT STATIONS IN 1941

THE preparation of the annual report to Congress by the Office of Experiment Stations on the work and expenditures of the agricultural experiment stations for the fiscal year ended June 30, 1941, has brought together the usual progress reports of the more than 3,000 federal grant projects active at the stations during that year. It is now expected that in due course these activities will be discussed in that report, but on an abbreviated basis in conformity with the national need and policy to conserve both paper and the printing funds. In the meantime the opportunity is being availed of to place on record brief statements of a few of the more significant accomplishments. These examples have been selected as representative of the subject matter fields covered in station research and the varied agricultural conditions and problems of the states and territories. They are based on statements as to the work done and the progress made under each active federal project, prepared by project leaders and made available to the office by the station directors. It needs scarcely be emphasized that they

are to be regarded as typical of the work but in no sense inclusive. The order of presentation is also largely random.

A simple low-cost plastic material from cottonseed-hull bran for the manufacture of sheaves for textile looms has been perfected by the Tennessee Station and developed in a commercial molding plant. Several hundred thousand of these sheaves already are in practical use and are demonstrating their superiority to those made of other plastics. Utilization of cottonseed-hull plastics for special purposes where strength and hardness are required promises to increase appreciably the value of a cheap by-product of the cotton-production industry.

A coumarin compound has been isolated by the Wisconsin Station from sweet clover and identified as an anti-blood-clotting factor. Selective breeding of sweet clovers of low coumarin content is now possible to obviate the disease of cattle which sometimes develops from sweet-clover feeding and may cause bleeding to death from wounds. The discovery has also been found of value in human medicine, as the new compound and others related to it may be used in treating human diseases in which it is desirable to lengthen the clotting time of the blood.

Studies by the Kansas Station on the milling and baking quality of wheat indicate that undue importance has been given to test weight in grading wheat that has been swelled by exposure to rain. When the test weight of Turkey wheat of good quality was reduced as much as 6 pounds per bushel by wetting, a degree which would have meant heavy discounts if sold commercially, milling value was affected to only a negligible extent and in most cases the baking qualities were not impaired materially.

Improvements by the New Mexico Station in pinto beans as to color, maturity and rust resistance have resulted in three new strains which have shown an increased value at average prices in New Mexico of about $2 per acre on dry land and of $11 on irrigated land. Sufficient seed was expected to be available in 1942 for the entire state.

Following studies by the Maine Station, a yield equivalent to at least 5,000 pounds of 4 per cent. milk per acre is being produced in that state with Ladino clover. This is from 1,000 to 1,500 pounds more than is usually obtained with common grassland crops on fertile soil.

Pasteurization of dill pickles shortly after the completion of the curing period was found by the North Carolina Station, in cooperation with the department, to preserve crispness of flavor long after unpasteurized pickles have become unsalable because of softening. This development is seen as a boon to dill-pickle packers, especially in the Southern states.

Failures to control red scale insects, one of the most important pests of citrus, by fumigation with hydrocyanic acid have been found by the California Station to be due to the ability of certain resistant races of these insects to close their spiracles (breathing pores) when exposed to the gas and to keep them closed for at least 30 minutes. A search is being made for substances which can be combined with hydrocyanic acid and will result in earlier opening of the spiracles.

Double-hill planting of tomatoes was found by the Utah Station, in cooperation with the department, to reduce greatly the loss of plants by beet leafhopper attacks and transmission of curly-top disease. Even under light infestation the increased yield paid for the extra plants needed. Cheesecloth covers were also effective but ordinarily too expensive.

A mixture of chloronaphthalene oil and crystal naphthalene 3:1, developed by the Massachusetts Station, gave complete control of red spider of carnations in greenhouses and was less expensive than naphthalene alone.

In a search for cheaper sources of nitrogen in animal feeding, experiments with urea, a non-protein compound in which the nitrogen generally costs only from one fourth to one third as much as its equivalent in the usual protein supplements, have been carried on in several States and Hawaii. The Wisconsin Station obtained very favorable results with urea as compared with linseed meal for dairy cows as to milk production, butterfat, protein, and vitamin C content of the milk, and the production of normal calves. In lamb feeding a lower value for urea than for linseed meal has been obtained by the New York (Cornell) Station when used as a practically exclusive source of nitrogen, but with equal parts of the two feeds the combination was only slightly less valuable than linseed meal alone.

Wide variations in fertilizer requirements of sugarcane under different environmental conditions have made economical use of fertilizers difficult of determination. The Hawaii Station, in cooperation with the Hawaiian Sugar Planters Association, has found that by sampling the sheath of the young mature leaf and determining the content of sugar, water and minerals, a very reliable guide for fertilizing and irrigating can be obtained, based on known responses on soil types under local conditions of light and temperature. Such intensive applications of fundamental scientific knowledge promises to decrease costs of production by securing sugar accumulation close to the highest level possible. This is an important contribution to the economic stability of a territory largely dependent on its efficiency in production on a little over a quarter of a million acres.

The Missouri Station has succeeded in chemically combining the proteins of skim milk with iodine to produce an artificial thyroprotein which has the physiological properties of thyroid substance. In short feeding trials, milk production of goats was increased by feeding 5 to 10 gm daily of the artificial thyroprotein, and cows which were falling off in milk production were stimulated to produce more milk by feeding 50 to 100 gm daily. This cheap source of thyroprotein may prove a practical way of increasing milk production of dairy cattle.—*Experiment Station Record.*

SCIENTIFIC BOOKS

Muscle. Vol. 3, Biological Symposia. Edited by WALLACE O. FENN. ix + 370 pp. Lancaster, Pa.: Jaques Cattell Press. 1941. $3.50.

IN the explosive, self-restituting phenomena associated with the substance myosin, muscle presents a challenge to many minds. "As a gadget which works," remarks the editor, "it has an obvious fascination for any boy or girl. It has," he adds, "a similar fascination for physiologists, the what-makes-it-go boys of biology." Augmented by additions to the initial list, the range of this symposium stretches from the rigors of bio-mathematics to the whimsies of bio-reminiscence; indeed, from the mechanics of powerful locomotor systems to that of the submicroscopic protein particle.

With rare technical skill, the Ramseys have subjected the individual muscle fiber to many crucial tests. That the functionally end-plateless fiber can be, throughout, both receiver and transmitter of excitation is strongly supported in their experiments. One of the most interesting of these reveals a singular perversity on the part of fibers permitted to shorten to 60–70 per cent. of resting length. In this "delta" state the fiber, among other changes, loses its intrinsic property to relax.

As an outgrowth from a discussion of the above studies, F. H. Pratt's historical sketch of the all-or-none concept as applied to muscle seeks its motive in Ranvier's expression, *la devise du coeur.* The type of response formulated by this "motto" is compared as a norm with deviations common to muscular behavior.

H. A. Blair analyzes mathematically the alternative features of the excitatory process: a threshold quantity of local change, and a phase of subsidence when that change falls short of threshold value. It is evident that the field is charted by the strength-duration curve. The conditions are treated with reference to selected models, of which the single polarizable membrane is found to be as adequate as the double. Dr. Street collaborates in the ingenious experiments on single fibers.

The behavior of smooth muscle is traditionally capricious. Can it be harmonized with the stereotyped capacity of skeletal and heart muscle to discharge discrete impulses and to conduct them in all-or-none fashion with a concomitant action potential? E. Bozler makes the distinction between the "multi-unit" type of smooth muscle, dependent upon outside innervation, and the automatic "visceral" (syncytial) type. Their potentials are interpreted respectively as (1) bursts of impulses referable to the discharge of discrete motor units; (2) repetitive impulses accompanying syncytial conduction. The rat's ureter presents a special case, with potential-complex typically cardiac.

A. S. Gilson, Jr., assuming protoplasmic continuity in smooth muscle, suggests that lack of uniformity in size of bridges may explain the electrical irregularities; and suggests that repetitive activity of one cell might simulate the responses of a group.

It is pointed out by A. Rosenblueth that smooth muscle is conductively heterogeneous. Long fibers, striated or smooth, show much the same type of conduction—an all-or-none effect, with potential ahead of contraction. As in Bozler's experiments, the same may be true of the short, presumably syncytial uterine muscle during estrus. Nictitating membrane and pilomotors fail to share the conductive function: here the diffusion of a chemical mediator can be invoked to explain nervous control of relatively distant cells.

The nerve-muscle junction is examined by T. P. Feng, chiefly in the light of Wedensky inhibition. Numerous important sub-topics conclude with "Local Potentials in Non-curarized Muscle." These, in summating, resemble those in completely curarized muscle, although probably not strictly localized to the end-plate. The many data analyzed lead to the following via media:

> If the spike potential and the liberation of AC [acetylcholine] in the nerve endings are intimately coupled concomitant events, the least arbitrary view at present is perhaps that which allows the actions of AC and of the spike to be mutually reinforcing, forming together an exciting complex which might even include other elements, *e.g.*, potassium ions.

In surveying the past decade of work on action potentials, A. C. Young deals first with investigations extending the membrane theory. The speeding of propagation by rise of temperature and by stretching is cited in its contributory relations. The after-poten-

tial as connected with the chemical changes is also considered, with emphasis on its temporal relation to a tension development so variable as to necessitate a separation into types. In rejecting "the conclusion that the action potential is due mainly to electrical changes at the end plate," the author voices his adherence to the intrenched theory.

In the article by Dugald Brown we witness an attack upon the redoubt that guards the secret passage between the chemistry and the mechanics of contraction —"the link between the chemical cycle and the shortening in the myosin linkages." It is possible only to note the main concept emerging from this penetrating study:

> We may suppose that at rest the active linkages are maintained in the resting state by a chemical system, some component of which is built into the linkage. In terms of a chemical system, this may well be a phosphoric ester. On stimulation, it is supposed that the linkages are activated, and that energy liberation ensues.

It is easy to think of muscle as acting universally by direct exercise of tension. But we are reminded by H. Elftman that in the great phylum of arthropods and the subphylum of vertebrates, where pivoted levers are "standard equipment," the somatic musculature employs a rotational system compelling the recognition of *torque,* of which tension is but one component. The oscillatory nature of bodily movement involves initial tension of the stretched muscle, and falling tension with rising speed. The author's analyses of torque-values in locomotion are based largely upon his own work in this reclaimed field.

In further aid to the concept that begins with the chemo-mechanics of the protein chain, and ends with torque, we are introduced by Ernst Fischer to the fascinations of dynamic crystallography. X-ray diffraction permits assumption of a three-dimensional, intramicellar, molecular lattice-work, the "repeat" pattern of which is prototype to the rhythms of microscopic structure.

F. O. Schmitt, agreeing with Dr. Fischer's view that the molecular changes educed "may still be far away from the conditions realized in nature," warns against too strict interpretation of form-birefringence data, and notes the modern substitution (for the concept of Naegeli) of an intermicellar lattice in what would correspond to Fischer's second-order pattern, intermediate between the microscopic and the molecular-crystalline.

The broad evidence from respiratory metabolism that food-stuffs are "burned" in the body favored the earlier concept of an internal-combustion engine. The peril of such analogy is long since realized. In Dr. Meyerhof's welcome contribution—the only one from Europe—oxidative factors are examined in the light of their history. The upshot of the author's analysis is his adherence to the "classical" view, in appraisal of work based upon the opportunely slow reactivity of cold-blooded muscle, and supported in the face of newly threatening revolution by the results (1940) of D. K. Hill. Agreement between the course of oxidative restitution heat and the determined assumption of oxygen is cited in affirmation of "the anaerobic nature of the fundamental process of contraction."

The general physiology of muscle—a discipline still in its inception—to an important extent owes its retardation to the unorganized state of comparative histology; and it is well to remember the diversity of conductive and contractile mechanism lying outside our own numerically insignificant group. Consider that our fellow chordates, the tunicates, outpoint the Mammalia in number of species by perhaps 50 per cent. Mysteries there are in C. A. G. Wiersma's account of what lurks within the exoskeleton of the arthropod legion: a single nerve fiber that actuates a whole muscle to quick contraction; another that is "slow" in its effect; another that inhibits; on each muscle fiber a dense feltwork of terminals like the stops to an elaborately keyed flute!

Medically, muscle has long failed of intrinsic interest. Save as indicator of nervous derangement, muscle, like consciousness, was left to take care of itself, if in so saying we ignore the debt it owes to the surgeon's hand. But the debt is reciprocal; and the thought that muscles not only keep us warm, but move the governing levers of the world's work and implement man's subtlest emotion, should be not without its share of inspiration.

Seldom have results of apparently pure academic interest had a speedier application to medicine than those recently derived from the chemistry of muscle and of neuromuscular transmission. Drs. Gammon, Harvey and Masland review the mechanisms involved in myasthenia gravis, myotonia and allied states. The reversible contributory relation between pathology and therapeutics, on the one hand, and physiology, on the other, is vividly illustrated.

The sensitivity of electrolyte balance and distribution to muscular behavior, conditioned as it is by the properties of the plasma membrane, admits of highly exact treatment; and in R. B. Dean's mathematical study, where unexplained facts must be faced, the operation of a mechanism for doing work upon the system is postulated in order to "pump out the sodium or, what is equivalent, pump in the potassium" against obstacles imposed by the equilibria of classical theory.

The issue between those who ascribe neuromuscular transmission to chemical means and those whose choice of transmitter is electrical, is not sharply drawn in this series: as already noted, Dr. Feng has offered a

via media to the pilgrim. But our concluding contribution is from the frankly "electragonist" camp, where Drs. Eccles, Katz and Kuffler analyze the potentials peculiar to the neuromuscular junctional region with the aid of modifications imposed by curare, eserine and the ingenious use of the muscle impulse itself, back-fired against the junction. The conclusion is significant that endplate effects are depolarization effects, and so germane to the classical excitation process.

The Protean physiology of muscle can provide in this single volume hardly more than a sample antebellum cross-section. Yet to secure it can have been no light task. The succinct treatment of the parts minimizes the lack of an index; and the format, uniform with other numbers, continues the tradition of a finely wrought series.

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REPORTS

SECOND REPORT OF THE WAR POLICY COMMITTEE OF THE AMERICAN INSTITUTE OF PHYSICS[1]

REVIEW OF FIRST REPORT

IN its first report[2] issued on May 1, the War Policy Committee of the American Institute of Physics explained the reasons for its existence and discussed matters of policy of concern to physicists as follows:

(1) Professional status of physicists—definitions of "physicist" and "professional physicist."

(2) Training in physics for the war—its strategic importance.

(3) Emphasis on the study of physics—as justified by war and post-war needs of the nation.

(4) Special training of physicists—required for the war.

(5) Use of physicists—the importance of making full and efficient use of trained men in physics.

FURTHER REPORT ON MANPOWER

Since publication of the first report, the War Policy Committee has devoted special attention to the national manpower situation in physics. The situation has the proportions of a national emergency and is, the committee believes, coming to be recognized as such by the Army, the Navy and the War Manpower Commission. The emergency may be stated as follows:

(1) The design, production, operation and maintenance of new physical instruments of warfare are essential to the successful prosecution of this war. (Examples: submarine and aircraft location, improvement of anti-aircraft fire, automatic fuses, signaling devices, magnetic mines, etc.)

(2) The need for more physicists for these purposes is large and urgent.

(3) The number of physicists in this country is small, only about 7,000, and a substantial portion of these are already engaged in direct war work, leaving much too few to provide physics training for Army and Navy personnel and those needed for war research and production.

(4) Training of physicists is not an easy or short-time process.

(5) Unless prompt, effective measures are taken the shortage of physicists will be disastrously acute and no adequate program for training new physicists can be effected.

To meet this emergency the committee urges the Army, the Navy and the War Manpower Commission to take the following steps:

(1) Arrange for teacher training to provide for the very great amount of physics teaching which will be needed, not only in producing physicists, but in connection with training programs of the Army and Navy in which it is essential to convey some knowledge of physics to over 200,000 men and women within a year.

(2) Revise the situation of physicists with respect to Selective Service so as to assure students and teachers of physics the possibility of continuing their work without uncertainty.

(3) Provide loans, scholarships or other assistance to well-qualified students who need aid to continue their training in physics.

(4) Any men in the Army and Navy with physics training who are not actually employing that training in their work should be transferred to positions where physicists are now urgently needed either by detail or discharge.

(5) Start a public relations program as to the meaning of physics and its importance in the war, this being necessary to secure public approval and understanding of the necessity of the preceding four steps.

TEACHING LOAD 1942–43

The committee has studied plans of the Army and the Navy to enlist a large fraction of next year's college and university students in training programs to be carried on at the institutions. The programs include the Army Enlisted Reserve and the Navy V-1 program. The services rely on these programs to provide large pools of officer material and can be expected to make every effort to recruit them to the necessarily large enrolments to meet the essenti-

[1] July 19, 1942.
[2] SCIENCE, May 15, p. 508.

needs. The Navy program requires a substantial course in physics; the Army program is such as to increase above normal the number of students electing physics. On the basis of joint announcements of the services and conferences with their representatives, the committee has estimated that the teaching load in college grade physics will in 1942–43 be from two to three times the highest ever before sustained. This teaching load will fall on faculties necessarily depleted for war research and, in some instances, wastefully dissipated through the direct action or indirect influence of the Selective Service Act and the lack of knowledge in some local boards as to the importance of physics and its wartime role.

The committee welcomes the very specific directives which have been issued by Selective Service Headquarters, but urges that high officials of the Army and Navy issue statements emphasizing the necessity for students and teachers to continue their present work and affirm that in so doing the individuals concerned are performing the highest and most patriotic duty open to them. Such public statements, as well as occupational deferment policies, should particularly include graduate students, since these students are already contributing heavily to the teaching of physics and are being drawn more and more into war research.

Whatever actions may be taken by federal authorities (and some are known to be in preparation) designed to lessen the prospective shortage of teachers, the committee is convinced that they can not be wholly adequate. The committee, therefore, urges college and university administrations and faculties to use every expedient they can devise to prepare for the coming flood of enrolments in physics courses. This advice is all the more urgent in view of the fact that the war research programs must continue to expand and that additional faculty members will have to be called away from their teaching duties.

SPECIAL ARTICLES

RELATIONSHIPS OF THE HIGHER ARSENIDES OF COBALT, NICKEL AND IRON OCCURRING IN NATURE

THE interrelations of the higher arsenides of cobalt, nickel and iron has long constituted a mineralogical problem. An extended series of studies has been conducted in an attempt to arrive at a better understanding of this group. In this investigation minerals from numerous localities have been examined microscopically and by means of x-rays, and as many as possible of the compounds have been produced synthetically. Some time will necessarily elapse before a complete report is published. In the meantime, it is hoped that this brief account may provide a useful outline.

Previous attempts at synthesis reveal few claims to the production of the higher arsenides of these metals. Many of the conclusions reached are also in doubt, since the experiments were carried on more than a quarter century ago, and the materials produced were identified without the aid of either the reflecting microscope or x-ray diffraction. In the absence of such methods it was neither possible to establish the homogeneity of the product nor to identify the phases obtained.

The present investigation has been carried on in ...eralogical and x-ray diffraction laboratories of ...tment of Geology at Columbia University. ...takes pleasure in expressing his sincere ...r the unfailing encouragement, advice ...cism of Professor Paul F. Kerr, of ...whose suggestion the investigation ...e method of synthesis employed throughout has been that of dry fusion. X-ray powder diffraction methods utilizing both Debye and Bohlin-Phragmen cameras with iron radiation have been employed in the determination of the homogeneity of the product, in the identification of the phases present and in the correlation of the synthetic and natural material. The x-ray data have been confirmed in many cases by the use of the reflecting microscope.

Orthorhombic Arsenides RAs_2

Safflorite	Rammelsbergite
Löllingite	Pararammelsbergite

Synthetic equivalents of rammelsbergite, pararammelsbergite and löllingite have been for the first time identified with the natural minerals by means of x-ray diffraction. The synthesis of "safflorite" was unsuccessful except when iron was employed in addition to cobalt, this cobalt-iron material giving a diffraction pattern of the safflorite type. Patterns of natural safflorite and the synthetic cobalt-iron compound are similar to those of löllingite. Furthermore, no orthorhombic diarsenide of pure cobalt has been reported in nature nor has it at any time been prepared synthetically. All analyses of the mineral safflorite are high in iron. Safflorite should be redefined as a cobaltiferous löllingite and has doubtful merit as an independent species.

Isometric Arsenides

RAs_2	RAs_3
(*Smaltite)	Skutterudite
(*Chloanthite)	Nickel Skutterudite
(*Arsenoferrite)	Iron Skutterudite

*(Discredited)

Although many published analyses of these minerals roughly approximate the composition $R:As_2$ others vary widely in arsenic content, indicating a range from approximately $R:As$ to $R:As_3$. The assumption of the existence of two distinct series, one of diarsenides of cobalt, nickel and iron, respectively (smaltite-chloanthite-arsenoferrite), the other of triarsenides (skutterudite-nickel skutterudite-iron skutterudite) is a consequence of this variability in metal-arsenic ratio. Since few specimens have approached the $R:As_3$ ratio, some mineralogists have considered the diarsenides to constitute the only valid group and have looked upon the skutterudites as arsenic rich varieties of the diarsenides. Another feature which must be considered in any discussion of the interrelations of these minerals is the extensive isomorphous substitution among the three metallic elements, a phenomenon that has long been recognized.

Oftedahl established the crystal structure of skutterudite employing the assumption that the formula was $R:As_3$ and demonstrated that the x-ray data could be reconciled with this composition, but was in no way compatible with a composition $R:As_2$. However, he left unanswered the explanation of the anomalous situation in which it appears that diarsenides and triarsenides of the same metals possess identical crystal structures. He also offered no satisfactory evidence to explain the variation in lattice constants shown by the natural isometric arsenides or the variable arsenic content indicated by the published analyses. The present investigation has had as one of its primary purposes the clarification of this situation.

Study of the naturally occurring isometric arsenides coupled with experiments in synthesis suggests that the so-called isometric diarsenides smaltite-chloanthite-arsenoferrite should be discredited as valid mineral species and the name skutterudite should be substituted for the entire group of isometric arsenides of cobalt, nickel and iron. This appears to be the only satisfactory solution of the apparently anomalous situation in which diarsenides and triarsenides of the same metals possess the same crystal structure. The variations in lattice constants and arsenic content shown by the natural arsenides may be satisfactorily accounted for under this revised view of the relationships of these minerals. The reasons for the above conclusions may be enumerated as follows:

(1) Published analyses of these minerals only approximate the theoretical metal-arsenic ratio $R:As_2$ and exhibit wide divergence in both directions approaching $R:As$ and $R:As_3$.

(2) The majority of published analyses were made many years ago and are of questionable reliability, since neither microscopic nor x-ray methods were employed in establishing the homogeneity of the analyzed material.

(3) Oftedahl, using only one specimen each of smaltite and chloanthite, established the essential identity of structure of these minerals with that of the triarsenide skutterudite. This has been amply confirmed in the present investigation employing many specimens of so-called diarsenides from a large number of localities.

(4) Furthermore, it was established by Oftedahl that the x-ray diffraction data provided by the natural arsenides of these metals is only compatible with the composition $R:As_3$ and can not be reconciled with a composition $R:As_2$.

(5) Cobalt triarsenide and a series of triarsenides isomorphous with it containing varying amounts of the metals cobalt, nickel and iron have been successfully synthesized in the course of the present investigation, whereas attempts to synthesize isometric diarsenides of these metals have been unsuccessful.

(6) The natural isometric arsenides exhibit a variation in lattice constants which is of approximately the same range as that shown by the synthetic isometric arsenides. Since the variation in lattice constants of these synthetic compounds is dependent on mutual substitution among the three metallic elements cobalt, nickel and iron, it seems likely that the same may be true in the case of the natural minerals. Previous suggestions of others that the substitution of metal for arsenic may account for this phenomenon are not supported by the present investigation.

(7) Microscopic examination of many specimens of smaltite and chloanthite demonstrates that the low and variable arsenic content of the so-called diarsenides can be accounted for, in many cases at least, on the basis of mechanically admixed lower arsenides. Wide-spread lack of homogeneity is evident. Niccolite, rammelsbergite and other lower arsenides frequently appear within apparently homogeneous crystals of the isometric arsenides. No evidence of metal for arsenic substitution was observed among the synthetics although the subject has not been exhaustively investigated. Even should it be established that metal for arsenic substitution exists in certain cases, the fundamental basis for the recognition of the so-called diarsenides as valid species is not strengthened, since they possess a crystal structure shown by Oftedahl to be compatible only with the composition $R:As_3$. In the former case they would be impure skutterudites, in the latter arsenic poor skutterudites but skutterudites they remain.

The present classification, theoretical compositions

and crystal systems of the principal naturally occurring higher arsenides of these metals and a revised classification based in part on the results of these experiments in synthesis are shown below.

Previous Classification	*Composition*
Orthorhombic Arsenides	
Safflorite	$CoAs_2$
Rammelsbergite	$NiAs_2$
Pararammelsbergite	$NiAs_2$
Löllingite	$FeAs_2$
Isometric Arsenides	
Diarsenides	
Smaltite	$CoAs_2$
Chloanthite	$NiAs_2$
Arsenoferrite	$FeAs_2$
Triarsenides	
Skutterudite	$CoAs_3$
Nickel-skutterudite	$NiAs_3$
Iron-skutterudite	$FeAs_3$

Revised Classification	*Composition*
Orthorhombic Arsenides	
*Cobalt-löllingite (Safflorite)	$(CoFe)As_2$
Rammelsbergite	$NiAs_2$
Pararammelsbergite	$NiAs_2$
Löllingite	$FeAs_2$
Isometric Arsenides	
Diarsenides (Discredited)	
Smaltite (Identical with skutterudite)	
Chloanthite (Identical with nickel-skutterudite)	
Arsenoferrite (Identical with iron-skutterudite)	
Triarsenides	
Skutterudite	$CoAs_3$
*Nickel-skutterudite	$(CoNi)As_3$
*Iron-skutterudite	$(CoFe)As_3$

* Indicates pure mono-metallic end member neither satisfactorily established as occurring in nature nor produced synthetically.

For the first time the existence of the orthorhombic minerals rammelsbergite, pararammelsbergite and löllingite as arsenides of the pure metals has been confirmed by the results of synthesis and x-ray studies. Consideration of the data for both natural and synthetic "safflorite" provides no evidence of the existence of a pure orthorhombic cobalt diarsenide and suggests that this mineral might be considered a cobaltiferous löllingite rather than an independent species.

In view of the previous discussion it would seem that the names smaltite, chloanthite and arsenoferrite, which have long been applied to minerals accepted as isometric diarsenides of the elements cobalt, nickel and iron, respectively, no longer serve any useful purpose. In fact, their retention in the literature tends to confuse our view of the relationships of the isometric arsenides of these metals, all of which are apparently structurally triarsenides whether or not they can be shown to possess the exact chemical composition demanded by the $R:As_3$ ratio.

Furthermore, it would seem that the name skutterudite should be applied to the entire group of isometric arsenides of cobalt, nickel and iron, since the cobalt triarsenide is the most firmly established of all the isometric arsenides of these metals. In the course of the present investigation it has been synthesized and the identity of the synthetic product and the natural mineral skutterudite established for the first time. The same investigation has established the existence of a three-fold isomorphous series of isometric triarsenides ($CoAs_3$-$NiAs_3$-$FeAs_3$) in which the elements cobalt, nickel and iron substitute for each other in various proportions. The nickel and iron end members of this series have not been synthesized; neither has their existence in nature been satisfactorily established. The precise limits of substitution of the three metals in the series are yet to be determined. Inasmuch as pure nickel and pure iron end members are missing there is little justification for assigning them special names. It would seem preferable to apply the appropriate prefix, as has already long been done in the case of nickel skutterudite for the high nickel, high iron or high nickel and iron varieties.

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EFFECT OF MUCIN ON INFLUENZA VIRUS INFECTION IN HAMSTERS[1]

IN a study of factors which decrease the resistance of experimental animals to virus respiratory infections, the effect of the intratracheal inoculation of hamsters (*Cricetus auratus*) with influenza A virus in mucin has been determined.

The hamster was selected as the test animal because it appeared, from Taylor's work,[2] to have a limited susceptibility to this virus, as evidenced by failure to develop gross lesions. Mucin was used, since it has been shown to lower resistance to bacterial infections;[3] further, the possible role of mucous secretions in decreasing resistance to infections of the respiratory tract in general has been the subject of several papers by our group.[4,5,6]

METHOD

The PR-8 strain of influenza A virus[7] was main-

1 This work was aided by a grant from The Kresge Foundation.

2 R. M. Taylor, *Proc. Soc. Exp. Biol. and Med.*, 43: 541, 1940.

3 W. J. Nungester, A. A. Wolf and L. F. Jourdonais, *Proc. Soc. Exp. Biol. and Med.*, 30: 120, 1932.

4 W. J. Nungester and L. F. Jourdonais, *Jour. Infect. Dis.*, 59: 258, 1936.

5 W. J. Nungester and R. G. Klepser, *Jour. Infect. Dis.*, 63: 94, 1938.

6 W. J. Nungester, R. G. Klepser and A. H. Kempf, *Jour. Infect. Dis.*, in press.

7 Obtained through the courtesy of Dr. Thomas Francis, Jr.

tained by mouse passage, and 0.1 ml of a 1 per cent. suspension of infected mouse lung in mucin or physiological saline was the inoculum used. The hamsters were two to six months old. Sterile 5 per cent. gastric mucin suspensions were prepared according to a technique previously described,[4] and also by a method to be published in a subsequent paper. Both preparations were satisfactory.

The hamsters were anesthetized by the intraperitoneal injection of Nembutal. Since intratracheal inoculations through the mouth with the aid of a catheter were not satisfactory, the trachea was exposed and 0.1 ml of the virus suspension in mucin, or physiological saline, was injected with a 25-gauge needle. The skin was then sutured. In one experiment, six hamsters were injected with 0.1 ml of virus previously neutralized with inactivated rabbit influenza A antiserum.

The animals were sacrificed six to eight days after inoculation, the lungs were removed, and gross pathological changes observed. The data from a few animals with concomitant bacterial infections, as determined by positive cultures on blood agar, were not included.

RESULTS

The results summarized in Table 1 indicate that when influenza A virus was suspended in sterile mucin, and injected intratracheally in hamsters, gross lung lesions developed which were similar to those seen in the lungs of mice infected with this strain of influenza virus. Since the incidence and extent of the lesions were markedly reduced, using an inoculum of mucin and influenza A virus neutralized with specific antiserum, it may be concluded that these results were not due to other viruses or bacteria present as contaminants. It should be noted that evidence of consolidation, however slight, is recorded in the table as a gross lesion. This may direct some unwarranted attention to the occurrence of lesions in animals inoculated with mucin alone, or with neutralized virus and mucin, since the lesions in these two groups of animals were small.

TABLE 1

THE USE OF MUCIN IN THE PRODUCTION OF INFLUENZA VIRUS PNEUMONIA IN HAMSTERS

Inoculum	Number of hamsters	Per cent. with gross lesions	Average number of lobes involved	Extent of lesion
Virus in saline ..	11	9	3	+
Virus in mucin ..	31	71	4	+++
Mucin	20	25	1	+
Neutralized virus in mucin	6	33	2	+ to ++

(+) Smallest visible lesion to 25 per cent. involvement, (++) 25 to 50 per cent. involvement, (+++) 50 to 75 per cent. involvement, of each infected lobe.

A. H. WHEELER
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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE PREPARATION OF SODIUM PYRUVATE

PYRUVIC acid, because of its important position in the intermediary metabolism of proteins and carbohydrates, is being used with increasing frequency in physiologic experimentation, including studies on tumor metabolism. The stable sodium salt is the most desirable form for handling this compound. However, the usual method of preparation of sodium pyruvate,[1] involving a very sensitive neutralization of small amounts of freshly distilled aqueous pyruvic acid with dilute alkali, is tedious and bothersome. The yield is often poor and contaminated with brown resinous condensation products.

If the neutralization of pyruvic acid is carried out in alcohol, sodium pyruvate, because of its insolubility, will be removed from the reaction as soon as formed. The following simple method, which is based on this fact, permits rapid preparation of any desired amount of the salt. Dissolve 10 ml (12.7 gm) of pyruvic acid (Eastman-498) in 100 ml of alcohol. Redistillation is unnecessary. (A sample which had stood in the laboratory for some weeks and was quite yellow yielded sodium pyruvate which appeared as good as the sample whose analysis is reported below.)

Sodium pyruvate: Calculated— C–32.71 per cent.; H–2.75 per cent.; Na–20.90 per cent.

$CH_3 \cdot CO \cdot COONa$ Found— C– 32.63 per cent.; 32.58 per cent.; H– 2.96 per cent.; 2.71 per cent.; Na– 21.15 per cent.; 20.83 per cent.

The acid is neutralized with alcoholic alkali made by diluting 10 ml of saturated sodium hydroxide with 100 ml of alcohol. The neutralization may be carried out at room temperature and does not have to be exact, for excess alkali is without immediate effect. (A preparation which had been considerably over-titrated showed only traces of yellow condensation products after standing 24 hours.) The sodium pyruvate, which precipitates as a white amorphous powder, is

[1] E. M. Case, *Biochem. Jour.*, 26, 753: 1932.

washed with alcohol and ether, and dried in a vacuum desiccator. Yield, 13.5 gms (85 per cent. of theoretical). Upon recrystallization from 80 per cent. alcohol glistening white plate-like crystals are obtained. No impurities were detected by polarographic analysis by Dr. R. J. Winzler.

WILLIAM V.B. ROBERTSON[2]

BETHESDA, MD.

DRAWING LAMP FOR CAMERA LUCIDA

ONE of the main difficulties in drawing microscopic objects by the aid of a camera lucida is that of balancing the brilliance of light on the drawing paper with that coming through the microscope. It is generally done by laboriously pushing a lamp around the table or by neutral filters which dim the image.

By the simple expedient of putting a variable resistor in series with the lamp, quick and easy control of illumination on the paper is accomplished. Such a scheme is shown diagrammatically in Figure 1, which indicates the connections of the three electrical components, power plug (P), rheostat (R) and lamp socket (S). In wiring the only caution to observe is that the rheostat turns *clockwise* to increase brightness of the bulb.

On the right in Fig. 2 is an easily made unit adaptable to any set-up of the microscope. It consists of a 3″ × 4″ × 5″ iron shield box (B) to hold the rheostat (R) and act as a base for the 15″ gooseneck tubing (T) and socket (S). These boxes have two loose sides which are held in place by screws in each corner. On the side used as a top are mounted the rheostat and a tripod fixture known as a "crowfoot" into which screws the flexible tubing. On the inside of the bottom plate a pound or so of sheet lead is bolted for

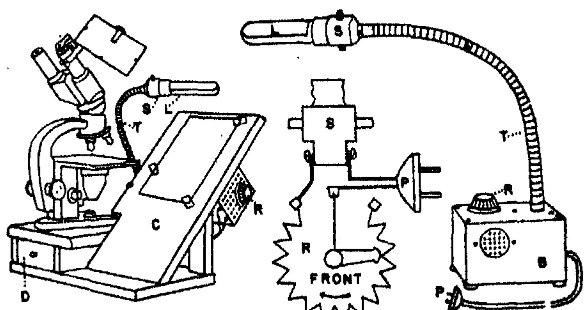

FIG. 3 FIG. 1 FIG. 2

ballast, and ventilation holes are punched in the sides and covered by metal screening. The socket has a push-through switch and holds a tubular half-silvered showcase bulb (L). As this bulb is small it causes less interference with the camera lucida mirror than the usual bulb and reflector of a desk lamp. The Mazda bulbs are made in two ratings 25 and 40 watt (120 volt). The 25-watt bulb is entirely adequate and the rheostat should be 500 ohms for proper dimming, and as it carries a maximum current of 0.25 amps. it must be in the 50 watt class.

For one who uses a binocular microscope and has much drawing to do it is well worth while to build the wooden frame with drawing board (C) and microscope stand in one piece (Fig. 3) which assures that all drawings are at the same magnification; paper can be conveniently fastened down by Scotch tape. The part of the camera lucida which fastens to the microscope is left in place and only the mirror removed so a dust cover can be put over the instrument at night. The gooseneck tubing (T) is fastened by the crowfoot directly to the frame, and the rheostat (R), enclosed by a guard of perforated metal, is mounted conveniently for the drawing hand. The board (C) *must be inclined from the horizontal exactly as are the* ocular tubes from the vertical to avoid distortion.

It will be noticed that the microscope is slightly elevated by the frame. We have found that this puts the eyepieces in a more comfortable position which eliminates some of the "stooping" associated with microscope work, and Dr. D. H. Linder has taken advantage of this space to insert a small drawer (D) in which to keep lens paper, micrometer-ocular, etc. This stand and lamp, as shown in Fig. 3, will surprise with its convenience anyone used to changing to the monocular, assembling the camera lucida and drawing on a flat table with daylight or an ordinary desk lamp. It is so easy to use that many objects can be sketched "when you see them" rather than waiting until some later time or being mislaid or neglected completely.

EDGAR V. SEELER, JR.

HARVARD UNIVERSITY

BOOKS RECEIVED

BENNETT, JESSE LEE. *The Diffusion of Science.* Pp. ix + 141. Johns Hopkins Press. $2.25.

BERNHEIM, FREDERICK. *The Interaction of Drugs and Cell Catalysts.* Pp. ii + 85. Burgess Publishing Company, Minneapolis, Minn. $2.25.

BUERGER, M. J. *X-ray Crystallography.* Pp. xxii + 531. Illustrated. John Wiley and Sons, Inc. $6.50.

FINCH, VERNOR C. and GLENN T. TREWARTHA. *Elements of Geography; Physical and Cultural.* Second edition. Pp. xii + 823. Illustrated. Ten plates. McGraw-Hill. $4.00.

FINCH, VERNOR C. and GLENN T. TREWARTHA. *Physical Elements of Geography.* Pp. x + 641. Illustrated. Ten plates. McGraw-Hill. $3.50.

LEHMAN, CHARLES H. *Analytic Geometry.* Pp. xiv + 425. John Wiley and Sons, Inc. $3.75.

LEVINE, MAURICE. *Psychotherapy in Medical Practice.* Pp. xiv + 320. Macmillan. $3.50.

MACY, ICIE G. *Nutrition and Chemical Growth in Childhood.* Vol. I. Pp. xxiv + 432. Illustrated. Charles C Thomas, Springfield, Ill. $5.00.

Physical Science. Edited by WILLIAM F. EHRET. Pp. x + 639. Illustrated. Macmillan. $3.90.

[2] Research fellow, National Cancer Institute, National Institute of Health, U. S. Public Health Service.

SCIENCE

VOL. 96 FRIDAY, AUGUST 7, 1942 No. 2484

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE TWENTY-SIXTH ANNUAL MEETING OF THE PACIFIC DIVISION

Edited by Professor J. MURRAY LUCK

SECRETARY

THE twenty-sixth annual meeting of the Pacific Division, American Association for the Advancement of Science, was held at Salt Lake City, Utah, during the week of June 15, 1942. The meetings extended over six days.

It was a notable week and an occasion deserving of record. Despite the exigencies of war and the pressing obligations of an unparalleled emergency, almost 400 scientists of the far western states were able to gather together for the purpose of friendly intercourse and the ever-necessary exchange of information from many fields of scientific research.

The meetings were of a particularly high quality throughout. General sessions commenced on the morning of June 15 with a symposium on "The Great Basin, with Emphasis on Glacial and Post-Glacial Times," in which three papers were presented by men whose studies have been largely centered upon the problems under discussion. The three papers were as follows: "The Geological Background," Dr. Eliot Blackwelder; "The Zoological Evidence," Dr. C. L. Hubbs and Dr. R. R. Miller, and "Climatic Changes and Pre-White Man," Dr. Ernst Antevs. The papers presented were of great interest, and it was thought by many that this symposium was one of the finest in the history of Pacific Division meetings.

On Tuesday afternoon at 1:30 the general sessions continued with "Reviews of Current Research," a session which consisted of four papers designed to review recent contributions in various scientific fields. The reviews presented were "Relationship Between Molecular Configuration and Resonance," G. E. K. Branch; "Recent Advances in Entomology," G. F. MacLeod; "Recent Developments in the Field of Disinfection," E. C. McCulloch; "Recent Work on Virus Diseases of Plants," C. W. Bennett.

At four o'clock President and Mrs. Cowles received the members and guests of the division and associated societies in the Union Building on the university campus.

On Tuesday evening Professor D. R. Hoagland, president of the Pacific Division for the year 1941 to 1942, presented the first evening address, "Progress in Investigations of the Nutrition of Plants."

One of the most enjoyable social events of the week was the organ recital given in the Mormon Tabernacle on Wednesday afternoon by Alexander Schreiner. It was followed by a reception at the Lion House, historic residence of the pioneer leader, Brigham Young.

"Researches in Dendro-Chronology" was the title of the evening address presented by Dr. Andrew E. Douglass, of the University of Arizona, on Wednesday evening.

On Thursday afternoon open house was held in the Geological Museum and Archeological Museum, following which tea was served by the University of Utah Women's Club.

The concluding evening address on "Recent Developments in Photography" was presented on Thursday evening by Dr. C. E. K. Mees, of the Eastman Kodak Company, Rochester, N. Y.

Business sessions of the executive committee and the council of the Pacific Division, American Association for the Advancement of Science, were held during the week. E. O. Essig was elected to fill the unexpired term of T. G. Thompson, who resigned his position on the executive committee. H. U. Sverdrup was elected to the executive committee in succession to F. B. Sumner, retiring from office on completion of five years of service. B. M. Allen and J. F. Kessel were elected as members-at-large on the council for four-year terms, in succession to C. L. Utterback and H. A. Spoehr.

Dr. Linus Pauling, of the California Institute of Technology, was elected to the presidency of the division, in succession to Professor D. R. Hoagland. Professors R. E. Clausen and J. Murray Luck were re-elected vice-president and secretary-treasurer, respectively.

A resolution of gratitude was unanimously adopted for the generous hospitality of the local sponsoring organizations—the University of Utah, Utah State Agricultural College, Brigham Young University, Weber Junior College and the Utah Academy of Sciences, Arts and Letters. It was announced that the 1943 meeting would be held in Corvallis, Oregon, under the auspices of the Oregon State Agricultural College. Professor R. V. Chamberlin served as chairman of the Committee on Local Arrangements for the Salt Lake City meeting.

SESSIONS OF AFFILIATED SOCIETIES

The reports of the scientific sessions of participating societies follow.

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS PACIFIC SLOPE BRANCH

(Report by Roy E. Campbell)

The 27th annual meeting of the Pacific Slope Branch of the American Association of Economic Entomologists was very successful, even though the attendance was reduced because of restrictions on travel. As a matter of fact, the lessened attendance seemed to increase the interest and participation in the discussion of papers presented, which reported on a wide variety of entomological projects in different Pacific Slope states.

Dr. P. N. Annand, chief of the Bureau of Entomology and Plant Quarantine, gave an outstanding address on "Insect Problems Affecting Food Production." He stressed the importance of the various problems now facing the entomologists in connection with our national efforts to produce sufficient food for ourselves and our allies.

The discussion on the subject, "What can we as entomologists do to be of most service to our country?" was participated in by most of those present and brought out some very interesting viewpoints. It was shown that the entomologist has a place in the armed forces, where his services are really needed in connection with insect problems affecting the health of military units and the protection of food stores. It was also brought out that all our efforts, whether in research, extension or teaching, should be concentrated on the control of insects affecting food and other materials used by the military and civilian forces in connection with the war, and less attention given to purely scientific problems or technical research which can be postponed until after the war.

Two very fine colored motion pictures were shown, one by Dr. A. J. Cox, chief of the Division of Chemistry of the California Department of Agriculture, the subject of which was "The Story of Economic Poisons." This showed the making and application of our various economic poisons. The other motion picture was "Combat," by the General Chemical Com-

pany, showing the fight against insect pests and plant diseases in the principal fruit and vegetable producing areas of the country.

New officers elected were: *Chairman,* Merton C. Lane, Bureau of Entomology and Plant Quarantine, Walla Walla, Washington; *Vice-Chairman,* K. W. Gray, Oregon State College, Corvallis, Oregon; *Secretary-Treasurer,* Roy E. Campbell, Bureau of Entomology and Plant Quarantine, Alhambra, California.

AMERICAN ASSOCIATION OF PHYSICS TEACHERS

(*Report by Orin Tugman*)

The American Association of Physics Teachers met on June 17. A paper was presented by Lynn W. Jones, of the University of Redlands, on "Correlations of Force and Field Intensity in Gravitational, Electrical and Magnetic Fields." The author of the paper not being present, the presiding officer of the meeting read the paper from manuscript supply. After discussion, the remaining time was devoted to the Symposium on the Role of the Physics Teacher in War Time. Dr. Willard Gardner, Utah State Agricultural College, Logan, Utah, read a paper on "Physics and Agriculture." This paper was a discussion on the relationships between agricultural food supplies and physics. Dr. Wayne B. Hales, Brigham Young University, Provo, Utah, read a paper on the "Significance of the Increased Demand for Physicists." In the discussion which followed it appeared to be a consensus of opinion that more publicity should be given to the deferment which may be allowed students of physics. It was pointed out that in many cases students are not aware of the proper procedure to secure deferment.

AMERICAN METEOROLOGICAL SOCIETY

(*Report by G. K. Greening*)

At the meeting of the American Meteorological Society from June 17 to 19, twenty-three papers were presented on a variety of subjects, divided into the following general groups: (1) Weather maps, forecasting, aeronautical meteorology; (2) agricultural meteorology and climatology; (3) theoretical and engineering meteorology, and (4) hydrology.

A new system for entering meteorological data on the daily weather map was explained by J. M. Lanning, of the Phoenix, Arizona, Weather Bureau Office. It is a three-dimensional system which gives not only length and breadth, but also depth to the weather map, and data relating to wind velocity and direction for various heights above the earth's surface are entered at certain set levels above the map by writing with ordinary ink on glass plates laid horizontally from wooden frames with a light near the bottom. Thus the use of a number of separate charts is eliminated, and it may be found that data other than that relating to air circulation can be entered on the plates.

Dr. Robert D. Fletcher, instructor in meteorology at the University of California at Los Angeles, discussed "Some Practical Relationships Involving the Vertical Wind Shear," concerning two relationships between the temperature field and change of wind with height. Assuming a geostrophic wind and that the slope of isobaric surfaces is small compared with that of isothermal surfaces, Dr. Fletcher arrived at an equation exactly similar in form to the geostrophic wind equation, but in which the pressure gradient is replaced by the temperature gradient, density by temperature and wind by the vertical wind shear.

Arnold Court, of the Los Angeles Weather Bureau Office, who was with the 1940–41 Byrd Antarctic Expedition, cited various proofs to show that there is no connection between air circulation in the Antarctic and in the rest of the world. Dr. Wayne B. Hales, of the Brigham Young University at Provo, demonstrated air mass movements and interactions by means of a Kodachrome motion picture, showing the movement of colored liquids in a density chamber.

Mathematical formulas from climatological data for determining the beginning and ending of the growing season and for predicting the occurrence of forest fires were explained by George L. McColm, Soil Conservation Service, Salt Lake City, and H. M. Shank, Forest Service, Ogden, Utah, respectively.

In the hydrology discussions A. R. Croft, of the Ogden Forest Service office, produced evidence indicating that the presence of foreign matter tends to increase the rapidity of snow melt, and J. Cecil Alter, of the Cincinnati Weather Bureau, presented a progress report on his investigation of the necessity for providing precipitation gauges with shields in order to secure an accurate catch.

AMERICAN PHYTOPATHOLOGICAL SOCIETY, PACIFIC DIVISION

(*Report by C. E. Yarwood*)

In the absence of the president and vice-president, the meetings were presided over by B. L. Richards, of the Utah Agricultural College. Twenty-two members were present from Arizona, California, Idaho, Utah, Wyoming, Washington, D. C., and Brazil. The meetings were organized into three sessions, at which sixteen volunteered papers were presented, and one symposium, at which eight invitational papers were presented.

H. S. Fawcett and A. A. Bitancourt discussed the host morphology and orchard distribution of the psorosis virus disease of citrus. C. W. Bennett re-

ported that curly top virus would live up to seven years in dried host tissues. W. G. Solheim found that certain natural illuminating gases found in Wyoming were relatively non-toxic to green plants. L. C. Cochran reported that peach trees affected with certain viruses tend to recover after the first acute symptoms of the disease. E. C. Blodgett described Coryneum blight on several stone fruits. Eubanks Carsner found that high temperatures could limit the occurrence of sugar beet downy mildew. W. J. Virgin reported that some storage diseases of carrots could be reduced by starting the storage period during the cool weather. B. Dundas found that lima bean powdery mildew is apparently caused by a *Microsphaera* and not by an *Erysiphe*. V. P. Sokoloff reported attempts to control citrus red scale by means of a soil bacillus. P. A. Ark reported control of crown gall by seed treatment, and described an important bacterial scab of carrot roots. Catherine Roberts showed the morphological similarity between *Taphrina* and *Torulopsis*. Dean Pryor found that big vein of lettuce could develop over a wide range of controlled soil moisture levels. C. E. Yarwood reported that hop downy mildew was reduced by using string supports treated with bordeaux.

At the symposium on "Breeding for Resistance to Plant Diseases," organized by H. Loran Blood, breeding onions for resistance to downy mildew, pink root and thrips was discussed by G. N. Davis; the development of powdery mildew-resistant cantaloupes was reported by Dean Pryor; curly top-resistant beans were reported by W. J. Virgin; mosaic-resistant beans were discussed by M. E. Anderson; breeding snap beans for resistance to powdery mildew and rust was discussed by B. Dundas; the performance of curly top-resistant sugar beets was reported by F. V. Owen, and limitations in the control of peach viruses by breeding was discussed by L. C. Cochran.

At the dinner meeting, B. L. Richards reported studies of the Western X disease of stone fruits.

Officers for the coming year are: *President,* L. D. Leach, University of California, Davis; *Vice-President,* B. L. Richards, Utah Agricultural College, Logan; *Secretary-Treasurer,* C. E. Yarwood, University of California, Berkeley; and *Councilor,* Glenn A. Huber, Washington Agricultural Experiment Station, Puyallup.

American Society for Horticultural Science

(*Report by John H. MacGillivray*)

Horticulture was represented on the "Breeding for Resistance to Plant Diseases" symposium by Glen N. Davis, who discussed onions, and D. E. Pryor and T. W. Whitaker, who outlined the progress in developing powdery mildew resistance in cantaloupes. Research has been progressing on both of these cooperative projects for over ten years. In both cases significant contributions of economic value have been made to our vegetable industry.

W. W. Aldrich gave the annual address at the Horticulturists dinner on "Irrigation in Horticulture To-day." Dr. Aldrich summarized our present knowledge on this subject based on experimental evidence and observations on a wide range of horticultural plants, climatic and soil conditions. He discussed these data from the standpoint of methods which may be used to determine when horticultural plants should be irrigated.

G. C. Hanna presented evidence that ten year yields on asparagus are better for determining the yielding ability of parent plants than shorter periods in a breeding program. Crown characteristics at time of planting failed to give evidence of future yielding ability. G. A. L. Mehlquist gave the necessary scientific background for the production of *Primula obconica* seed which can not be imported at the present time. H. E. Hayward and E. M. Long presented evidence that Elberta peaches gave different growth responses when grown on Lowell and Shalil rootstocks in high chloride and/or sulfate solutions. Roy W. Nixon reported on the effect of thinning treatments on the amount of "shrivel" in the Halway date. Light, medium and heavy pruning on the top regeneration of the Valencia orange was discussed by S. H. Cameron and R. W. Hodgson.

American Society of Ichthyologists and Herpetologists, Western Division

(*Report by Richard S. Croker*)

The meetings of the Western Division, American Society of Ichthyologists and Herpetologists, consisted of two symposia, a round table discussion and a half-day session of general papers. The high light of the meetings was the symposium entitled "The Great Basin with Emphasis on Glacial and Post-Glacial Times," which was arranged jointly by the society and the American Association for the Advancement of Science. Eliot Blackwelder spoke on the geological background, describing the evolution of the Great Basin and its surrounding mountains. Carl L. Hubbs, presenting a paper prepared jointly with Robert R. Miller, showed that the present distribution of fishes in isolated parts of the Great Basin substantiates the assertions of geologists regarding the history of this area. Ernst Antevs discussed the changes in climate of this area and how they affected the ancient inhabitants, as well as how the study of former inhabited sites indicates early climatic conditions.

The second symposium, "Problems of Management

of Trout Waters," emphasized conditions in the Inter-Mountain Region. Marion J. Madsen spoke on the objectives of management, chief of which is to "provide satisfactory fishing for the largest number of anglers at the most reasonable cost." James W. Moffett discussed environment and management, with emphasis on the fact that each body of water is a separate problem and that neither the general survey nor the intensive study is the sole approach. James R. Simon spoke on administrative considerations in the methods of management. He stated that "hatcheries still have a place in trout management but that the exaggerated claims for their success must be revised in view of the efficiency of natural reproduction."

A round table discussion on reptiles, "Seasonal Behavior Patterns," was led by A. M. Woodbury. The points discussed included the effects of temperature, humidity, light and other factors on such habits as denning and solitary hibernation, feeding, migration, breeding, etc.

Papers read at the general session included those on fish pigment by F. B. Sumner, fossil fish scales by L. R. David, proportion of scale length to fish length by L. D. Townsend and H. L. Connor, aboriginal use of fisheries by G. W. Hewes and the shark fishery by R. S. Croker.

Officers of the Western Division of the society for the ensuing year are: *President,* W. C. T. Herre, Stanford University; *Vice-President,* Raymond B. Cowles, University of California, Los Angeles; *Secretary,* Richard S. Croker, California Division of Fish and Game, Terminal Island, California.

(To be concluded)

THE RESOURCES OF THE CONTINENTS[1]

By Dr. KIRTLEY F. MATHER

PROFESSOR OF GEOLOGY, HARVARD UNIVERSITY

Any consideration of the changes that are likely to occur during the next few years in the social and political life of man must include the inescapable fact that the demands upon mineral resources are certain to increase. Not only in war but also in peace, human efficiency and comfort are increasingly dependent upon metallic ores, mineral fuels and the products of the ground. No matter what may be the nature of the new order for which men fight and plan and work, it can become a reality only if it is adjusted both to the peculiarities of human nature and to the characteristics of the physical resources available in this terrestrial environment. It is worth while, therefore, for all concerned with the fate of man to give careful thought to the nature and distribution of the raw materials with which Mother Earth's storehouse is stocked.

These basic requisites for modern civilization occur under certain well-defined geological conditions. Their distribution is by no means haphazard or unpredictable. Now that the general geological structure of all the continents is known and the specific occurrence of many valuable mineral deposits has been studied, it is possible to estimate with some degree of accuracy the total stores of the more important metals, fuels and other minerals that are available for human use, and to compare the relative wealth of the several continents with regard to mineral resources.

It may help in making such a survey to group the rocks of the earth's crust in three categories. First there are the very old, and generally much contorted or compressed rocks of the Basement Complex or Pre-Cambrian terrane. These include vast bodies of granite and other igneous rocks, many of them intensely metamorphosed, as well as sedimentary rocks that likewise have been greatly altered by heat and pressure during the many vicissitudes of crustal movement and volcanic eruption that have affected them throughout the long ages of subsequent geologic time. These ancient rocks contain many rich bodies of metallic ores, such as those yielding gold, silver, copper, nickel and iron. Nowhere do they contain coal, petroleum or the ores of such metals as aluminum and magnesium.

There are extensive areas of Pre-Cambrian rocks in every continent, and no large unit of these rocks has thus far failed, when adequately prospected, to be the source of essential metals. The Canadian Shield surrounding Hudson Bay in North America is matched by the Scandinavian Shield of northwestern Europe and the Angara Shield of north-central Siberia in Asia. In the southern hemisphere, the Brazilian Shield of South America is matched by the extensive bodies of Pre-Cambrian rock in south and central Africa and the Basement Complex of Australia.

The second group of rocks in this very loose classification of mine includes the sedimentary formations of Cambrian and post-Cambrian age. These may be flat-lying beds beneath the plains and in the plateaus or they may be wrinkled into mountains like the

[1] World-wide broadcast of the American Philosophical Society and WRUL, Philadelphia, July 17, 1942.

Appalachians. It is from these that the world's resources of coal and petroleum are secured, as well as much of the potash and magnesium and some of the iron and non-ferrous metals. Here too it should be noted that every continent has its share. The widespread basin of the Mississippi Valley in North America is matched by the extensive area of sedimentary rocks in central Europe between the Alps and the Scandinavian highlands. The vast lowland of the Amazon in South America finds its structural counterpart in the interior basin of Australia and the broad plains of north central Asia.

The third major type of geologic structure is that resulting from and associated with volcanic activity. Here the geologist has in mind not only the outpoured lavas and erupted cinders, ash and bombs of volcanic cones and plateaus. He thinks also of the intruded masses of igneous rock that crystallized in the conduits leading to the volcanic vents, or spread out in sheets or dome-shaped bodies in the upper part of the earth's crust without ever actually breaking through to the surface. It is in association with such rocks, especially those of Tertiary age, that some of the world's most important reserves of precious metals, of copper, lead and zinc, and of such metals as tungsten, vanadium, molybdenum and manganese, essential in the production of modern steel alloys, are found. Here, again, we observe that nature plays no favorites, so far as continents are concerned. The volcanic terranes of North America's western mountains have their equivalent in the Andes of South America, the festooned arcs of many a mountain system in eastern and southern Asia, the plateaus and cones of central Africa.

The fact is that every continent displays almost the entire gamut of possible geologic structures and therefore may be expected to contain extensive deposits of almost every kind of mineral resource useful to-day or likely to be useful in the future as a raw material of industry. Although the United States alone has thus far produced more than two thirds of the world's entire production of petroleum, this is because Americans have been more successful than any other people in finding and using this type of fuel. There is no chance that a century ago two thirds of the world's supply of petroleum was concentrated beneath the surface of the United States. On the contrary, with the exception of Australia, every continent probably contains petroleum reserves proportional to the entire total of the world's supply, as the area of each continent is proportional to the total land of the earth.

Similarly, the fact that, to date, Continental Europe, the United States, Great Britain and Russia have produced over 80 per cent. of the world's steel does not mean that the rest of the world contains only 20 per cent. of the earth's ores of iron. Instead it means that the inhabitants of the regions first mentioned have been most ingenious and efficient in discovering and utilizing the iron ore deposits that they possessed. The iron ores of Asia, Africa, Australia and South America for the most part await future development.

In other words, for the overwhelming majority of basically important minerals, each continent may be expected to have domestic sources, adequate when properly developed, to supply most of the needs of its inhabitants when the standards of living and the way of life everywhere attain the characteristics of modern industrial civilization. Mother Earth provides equality of opportunity; it is man that differs in responding to opportunity.

But this is not to say that nature favors continental isolation or regional self-sufficiency as the pattern for world organization. There are several significant exceptions to this glittering generality of equalized distribution of mineral wealth, continent by continent. Even when we remember that, for many purposes, molybdenum may be substituted for tungsten, coal for petroleum, and magnesium for aluminum, we find that at present and probably for a long time in the future, the inhabitants of no continent and therefore of no one country can "live to themselves alone," without sacrificing many of the benefits of modern civilization.

Outstanding among these exceptions is tin. Nature has played a strange trick in making tin ores scarce in the highly industrialized regions where the tin can is an essential item. There are practically no ores of tin in all North America, and the puny deposits of that metal in all Europe are competent to meet only 5 per cent. of the needs of Europeans.

Much the same can be said about the ores of nickel and of radium. These are found in only a few rare localities in only two or three of the six continents.

Even this hasty survey of the resources of the continents therefore leads us unerringly to the conclusion that if man is to make full use of the available mineral wealth, his social, economic and political organization must be on a planetary rather than a continental basis. Each continent has sufficient stores of raw materials to give it a place of equality with every other continent. From the geological point of view there is no basis for rating any continent as inferior to any other. But no continent can provide sufficient amounts of every ingredient of modern civilization to satisfy the needs of man. Only as each contributes freely and without hindrance to the welfare of all mankind can the resources of any be utilized to the best advantage.

The geologist can not escape the conclusion that the

earth is far better adapted for occupation by men organized on a world-wide scale with maximum opportunity for free interchange of raw materials and finished products the world around, than for occupation by men who insist upon building barriers between regions even so large as entire continents.

OBITUARY

WILLIAM JOHN PETERS

The death of Captain William John Peters on July 10 removed from American geophysics an outstanding scholar and investigator whose unselfish achievements in the field and laboratory are internationally recognized. He took part in almost every phase of research in earth physics and in quest of data he covered a large part of the earth's surface. Preeminent in his contributions was the geomagnetic work at sea and for which he invented and improved instruments making for more rapid and more accurate determinations.

Captain Peters was born in Oakland, California, on February 5, 1863, and was educated in the public schools there. After a short time as a student at the University of California, he was appointed as observer and computer on a survey of the boundary between two western states; in this work he gave much study to methods of astronomical determination not frequently used.

His important professional life began with appointment as assistant topographer in the U. S. Geological Survey in 1884. His advance through various grades was rapid. For several years he was engaged in geodetic work in the western states. During 1898–1901, as chief of party, he successfully completed difficult and important exploration in Alaska for the Survey and again during 1902 in Utah and Alaska.

This extensive experience, much of it in polar regions, fully qualified him for appointment as chief scientist and second in command of the Ziegler Polar Expedition of 1903–1905. Despite unusually severe meteorological and ice conditions, coupled with the loss of the expedition's vessel, Captain Peters succeeded in obtaining valuable 11-month series of geomagnetic data at Teplitz Bay, Rudolph Island, Franz Josef Archipelago, along with other material at Teplitz Bay, Cape Flora, and Alger Island, on aurora, meteorology, tides, geomagnetism, astronomy and map construction and surveys. In this his organizing ability and training of those associated with him were paramount factors. The extensive and detailed accounts of this work and of the resultant valuable geophysical data and discussions were published by the National Geographic Society in 1907 in a 630-page quarto volume entitled "The Ziegler Polar Expedition, 1903–1905: Scientific Results." The fact that the entire burden of the scientific program, except for only occasional assistance by other members of the expedition, was carried by Captain Peters and four assistants, makes this really a marked achievement in the history of polar exploration. Commander Anthony Fiala, of the expedition, regarded the amount of scientific work accomplished in the scant time available as "sufficient evidence of the indefatigable and persistent prosecution of the observations on the part of the scientific party."

Shortly after the return of the expedition, Captain Peters was appointed as chief magnetic observer and commander of the *Galilee* for the Department of Terrestrial Magnetism of the Carnegie Institution of Washington on her second and third cruises of over 52,000 miles in the Pacific Ocean and thus entered upon his second major service to geophysics. While on the *Galilee*, whenever possible, he experimented with the object of improving instruments and methods of magnetic observations at sea. As a result he developed the marine collimating-compass, which was destined to become the standard instrument for determining the magnetic declination on board the *Carnegie*.

As the result of the work done on the *Galilee* the special non-magnetic vessel *Carnegie* was designed along lines largely suggested by Captain Peters. He superintended her construction and commanded her first two cruises of over 100,000 miles, the second of which extended around the world with a total length of 92,829 nautical miles in 798 days. Important corrections to geomagnetic charts were found on this second cruise, particularly in the Pacific and Indian oceans. The detailed results and discussions obtained were published by the Carnegie Institution of Washington as the third volume in the series "Researches of the Department of Terrestrial Magnetism." These constitute a lasting memorial to the long labors and scientific genius of Captain Peters.

In 1914 Peters secured observations along the coasts of Labrador, Hudson Bay and Hudson Strait as well as at sea in Hudson Bay. Here again most valuable geophysical data were obtained despite unusual difficulties of season and navigation in the small three-masted schooner *George B. Cluett*.

Upon completion of the work in Hudson Bay, Captain Peters entered upon his third major service to geophysics in the direction at the Department of Terrestrial Magnetism of the compilations and discussions of the accumulated results at sea, the oversight of the continuing surveys at sea by the *Carnegie*, and the

investigation of fundamental problems of compass design, compensation and dynamic deviation, which continued until his retirement from active duty, June 30, 1934. A large part of the progress made in the investigations of the Department of Terrestrial Magnetism in its fields must be credited to Captain Peters in these twenty years of his professional life.

When the British Admiralty decided in 1935 to build a non-magnetic vessel—*Research*—to carry forward the geomagnetic survey at sea previously done by the *Carnegie*, that organization invited the Carnegie Institution of Washington to make available as an expert consultant the services of Captain Peters to aid in the vessel's design and in her instrumental equipment. Nothing illustrates so well the selfless interest and enthusiasm as his acceptance of this responsibility and the sacrifice of a year of his well-earned privilege of retirement. Arriving in England in the fall of 1935, as a representative of the Carnegie Institution of Washington, he took active part for over a year in the design of the new vessel and of her equipment—tasks for which his unique experience so peculiarly fitted him. The Admiralty took occasion to record its high appreciation of this valuable aid which had done so much to make possible the later launching of the *Research*. She was rapidly being equipped for her first cruise to Washington, D. C., and thence through the South Atlantic into the Indian Ocean, when the outbreak of the war in 1939 made it necessary to postpone her work.

Following his work in England and service as a delegate of the United States at the triennial Assembly of the International Union of Geodesy and Geophysics in Edinburgh in 1936, Captain Peters continued to devote much of his leisure time to scholarly studies. Many were the calls upon him as a recognized authority in polar exploration and nautical science. One of his last studies involved an investigation of the log of the cruise of Ponce de León and discussions bearing on his route to and landfall near St. Augustine, Florida.

Some 50 volumes and publications evidence the extent of Peters' scientific activities. These show not only a mind trained by practical experience but also one unusually skilled in higher mathematics and the exact sciences—acquired only by persistent study in each new field or problem as it was presented—and in their useful applications.

Captain Peters died at his home in Chevy Chase, Maryland, on July 10, 1942. He is survived by his widow, Beatrice Speaight Boyd Peters, and his son, Geoffrey Lloyd Peters.

All who had the privilege of acquaintance and friendship with Captain Peters unite in estimating him as a thoroughly modest gentleman and capable experimenter and investigator. All who served with him in any capacity unite in praise of his sympathetic unselfish guidance to attainment in their activities. His share in the edifice of geophysical science is a solid foundation for future building.

JNO. A. FLEMING
DEPARTMENT OF TERRESTRIAL MAGNETISM,
CARNEGIE INSTITUTION OF WASHINGTON

DEATHS AND MEMORIALS

MAURICE L. CARR, director of research of the Pittsburgh Testing Laboratory, died on July 13 at the age of sixty-five years.

DR. WILLARD A. ROBERTS, of the department of research lamp development at the Nela Park branch of the General Electric Company, died on July 24 at the age of fifty-two years.

SIR WILLIAM MATTHEW FLINDERS PETRIE, the British archeologist, died in Jerusalem on July 28. He was eighty-nine years old.

SIR DANIEL HALL, F.R.S., who was director of the Rothamsted Experimental Station from 1902 to 1912, died on July 5, at the age of seventy-eight years.

DR. RICHARD WILLSTAETTER, formerly professor at Munich and Berlin, Nobel laureate in chemistry, died in Switzerland on August 2. He would have celebrated his seventieth birthday on August 13.

THE recently completed two-story brick building on the grounds of the Connecticut Agricultural Experiment Station, New Haven, will be named the Britton Laboratory, in memory of Dr. Wilton Everett Britton. Dr. Britton, until his death in 1939, was for about forty years entomologist of the Experiment Station and state entomologist.

SCIENTIFIC EVENTS

THE ENDOWMENT OF AN INSTITUTE OF SOCIAL MEDICINE AT OXFORD

THE Nuffield Provincial Hospitals Trust, with the approval of Lord Nuffield, will, according to the *Times*, London, devote £10,000 a year for ten years to the creation at the University of Oxford of a university professorship of social medicine and the foundation of an institute in which the professor will work.

The purposes of the institute are:

To investigate the influence of social, genetic, environmental and domestic factors on the incidence of human disease and disability.

To seek and promote measures, other than those usually employed in the practice of remedial medicine, for the

protection of the individual and of the community against such forces as interfere with the full development and maintenance of man's mental and physical capacity.

If required by the university to do so, to make provision in the institute for the instruction in social medicine of students and practitioners of medicine approved by the board of the faculty of medicine in the University of Oxford.

There will be an administrative committee for the institute on which the trust will be represented by six members. In this way cooperation will be furthered between the institute and other research institutions established elsewhere by the trust.

Six years ago Lord Nuffield devoted £2,000,000, augmented later by gifts for special purposes of more than £600,000, to the endowment of medical research in the University of Oxford, believing that in a great university medical research would get inspiration and help from its contact with other studies of all kinds. In December, 1939, he endowed the Nuffield Provincial Hospitals Trust, of which W. M. Goodenough, who is chairman of the trust connected with medical endowment at Oxford University, is also the chairman. This trust is empowered to spend money on a wide range of purposes which can be of benefit to the hospital services.

FINANCES OF THE JOHNS HOPKINS UNIVERSITY, 1936–1942

The following account was given in *The Johns Hopkins University Gazette* of the finances of the university:

The 1936 sustaining fund was launched to meet the operating deficits, principally of the Homewood divisions of the university, which had in 1935 mounted to nearly $200,000 annually.

This appeal embraced two main objectives: first, to provide a sustaining fund of $750,000 to maintain operations on a satisfactory level for a three-year period; and second, to secure additional capital funds of $10,000,000 needed to insure stability and to continue the normal functions of a first-class university.

Subscriptions to the sustaining fund amounted to $560,000. This sum has met the operating deficits at Homewood during the seven intervening years, instead of the three years originally contemplated. In the meantime, the university fulfilled its promise to reduce expenses to a bare minimum. The annual deficit of $177,000 in 1936 has been reduced to approximately $34,000 in 1940–41.

Meanwhile, progress has been made on the second objective of the 1936 appeal through gifts and bequests to the university of nearly $4,000,000. The chief items making up this total are:

Estate of James Swan Frick	$324,000
Estate of Louis J. Boury	955,000
Gift of Henry Strong Denison Medical Foundation	100,000
Rockefeller Foundation for Preventive Medicine	350,000
Rockefeller Foundation for Biological Sciences	500,000
Estate of John Martin Vincent	945,000
Estate of Alfred Jenkins Shriver	158,943[1]

While these amounts have been received, because of restrictions imposed they are not entirely available for endowment funds. Neither the School of Medicine nor the School of Hygiene and Public Health was included in the appeal in 1936 for sustaining funds. The endowment of the School of Hygiene, restricted to its use, is sufficient at this time to care for the needs of the school.

Expenses of the School of Medicine, however, have increased materially, causing an annual deficit in 1936 of $5,089.31, mounting to $52,336.82 in the year just passed. These deficits have been met up to the present time by the expenditure of unrestricted funds available for such purpose. The chief item of increase has been in instruction and departmental research where expenditures from general funds have increased about $46,700; operation and maintenance of physical plant has at the same time increased approximately $7,900.

THE KING OF ENGLAND'S BIRTHDAY HONORS LIST

The following names of scientific men and others associated with scientific work appear in the King's Birthday Honors list, printed in *Nature:*

O.M.: Dr. E. D. Adrian, professor of physiology in the University of Cambridge.

Baron: J. M. Keynes, the distinguished economist.

K.C.M.G.: Sir Guy Marshall, director of the Imperial Institute of Entomology.

K.B.E.: Dr. C. G. Darwin, director of the National Physical Laboratory.

Knights: Dr. R. H. Fowler, Plummer professor of mathematical physics in the University of Cambridge, lately liaison officer in North America; Dr. W. H. Fyfe, principal and vice-chancellor of the University of Aberdeen; H. Gaskell, a director of Imperial Chemical Industries, Ltd.; W. Gavin, chief agricultural adviser, Ministry of Agriculture; L. Mason, deputy director-general of supply, India, and lately inspector-general of forests; Professor W. F. Shaw, president of the Royal College of Obstetricians and Gynecologists; Major-General J. Taylor, I.M.S., director of the Central Research Institute, Kasauli; R. A. Watson Watt, scientific adviser on telecommunications, Ministry of Aircraft Production.

[1] Actually received from a bequest approximating one million dollars.

C.B.: Dr. H. J. Gough, deputy controller-general of research and development, Ministry of Supply.

C.M.G.: Dr. D. B. Blacklock, professor of tropical hygiene, University of Liverpool; G. F. Clay, director of agriculture, Uganda; Dr. A. F. Mahaffy, director of the Yellow Fever Research Institute, Uganda.

C.I.E.: W. T. Hall, chief conservator of forests, United Provinces; C. M. Harlow, chief conservator of forests, Central Provinces and Berar; Colonel E. A. Glennie, director of the Survey of India; Lieutenant-Colonel G. R. McRobert, professor of medicine, Medical College, Madras; Dr. L. E. Napier, director of the School of Tropical Medicine, Calcutta; Lieutenant-Colonel E. McK. Taylor, director of the Irrigation Research Institute, Punjab.

C.B.E.: G. E. Bodkin, director of agriculture and principal of the College of Agriculture, Mauritius; Dr. E. A. Carmichael, director of the Neurological Research Unit of the Medical Research Council, National Hospital for Nervous Diseases; Dr. T. J. Mackie, professor of bacteriology, University of Edinburgh; F. J. Mortimer, lately president of the Royal Photographic Society; Professor A. C. Norman, director of the X-Ray Institute in Iraq and professor of radiology in the Royal College of Medicine, Bagdad; Dr. Z. F. Willis, general secretary of the Y.M.C.A.

O.B.E.: V. A. Beckley, senior agricultural chemist, Kenya; E. G. Bowen, senior scientific officer, Ministry of Aircraft Production; Dr. H. J. O'D. Burk-Gaffney, senior pathologist, Tanganyika; S. Butterworth, principal scientific officer, Admiralty; T. G. Henderson, principal veterinary officer, Basutoland; G. D. A. Macdougall, chief assistant, Statistical Branch, Prime Minister's Office; A. Monro, chief veterinary officer, Ministry of Agriculture; Dr. B. Prasad, director of the Zoological Survey of India; A. H. Stein, divisional forest officer, Hoshangabad, India; C. B. Symes, medical entomologist, Kenya; A. F. Thelwell, secretary of the Jamaica Agricultural Society; A. F. Wilkins, principal scientific officer, Ministry of Aircraft Production; H. Wooldridge, senior scientific officer, Department of Scientific and Industrial Research.

M.B.E.: Canon L. A. Lennon, for services to education and agriculture, in Nigeria; G. W. Lines, agricultural officer, Nigeria; R. E. Mills, technical assistant, Ministry of Aircraft Production; H. C. Mundell, agricultural and livestock officer, Basutoland; Miss K. M. Shaw, personal assistant to the dean of the London School of Hygiene and Tropical Medicine; L. B. Turner, deputy assistant director, Explosives Department, Ministry of Supply; J. J. Unwin, scientific officer, Ministry of Aircraft Production.

I.S.O.: G. D. Goode, chief clerk, Department of Science and Agriculture, and personal secretary to the Director of Agriculture, Jamaica.

DR. ALEŠ HRDLIČKA[1]

The retirement of Dr. Aleš Hrdlička from the curatorship of the Division of Physical Anthropology in the National Museum, Washington, which he has held for almost forty years, is an event which no scientific journal can leave unnoted. Under him there has grown up in the National Museum one of the greatest—if not the greatest—collections of anthropological material in all the world; he is founder and leader of the enterprising school of physical anthropology which now flourishes in the United States. Born in Czecho-Slovakia in 1869, he was still a youth when his family emigrated to the United States; there he became a student of medicine, and it was through the medical portal he entered upon the anthropological problems of the human body. On the anniversary of his seventieth birthday a list of his contributions to anthropology was compiled; they are now more than three hundred in number, covering every aspect of his subject, every one of them making a factual addition to a particular department of knowledge.

Dr. Hrdlička is beyond doubt the most traveled anthropologist of his time; there is no part of the world he has not visited in search of material and of knowledge. He made the circuit of the world several times to examine and report on the fossil remains of early man. His reports, issued from time to time in the publications of the Smithsonian Institution, are recognized throughout the world as the most reliable sources of fact relating to the discoveries of fossil man. His studies on the Old Americans (men and women of British ancestry), of the American Indians and of the Negro population of the United States have become classics. He has sought to trace the first peopling of the New World from a Mongolian homeland in northeast Asia and has explored Alaska for evidence of early migrations. In Alaska, too, he has dug up cemeteries attached to older Eskimo settlements; he has added greatly to our knowledge of the Eskimo, both ancient and modern. Dr. Hrdlička made warm friends wherever he went, particularly in England. He lectured in London in 1939 while on his way to the U.S.S.R. to examine the various finds of fossil man which have been made there in recent years. In 1926 his Czech colleagues issued a "Hrdlička" number of *Anthropologio* in honor of their distinguished countryman. At the close of the War of 1914–18 he founded the *American Journal of Physical Anthropology,* now the leading publication of its kind.

[1] From *Nature.*

RESEARCH GRANTS OF THE WISCONSIN ALUMNI RESEARCH FOUNDATION

Fifteen gifts and grants, the largest a $60,000 research allotment from the Wisconsin Alumni Research Foundation, have been accepted by the Board of Regents of the University of Wisconsin. The gifts amount to $89,054, and are largely for research in chemical, agricultural and medical fields or for student loans and scholarships.

The foundation also allotted $4,000 for a research fellowship in the department of pediatrics for 1942–43, to be supervised by Dr. J. E. Gonce.

Other gifts and grants were:

Commercial Solvents Corporation, Terre Haute, Ind., $1,250 to renew an industrial fellowship in biochemistry.

Wisconsin Canners Association, Madison, $300 to establish an industrial fellowship for studies on sweet corn.

Lakeshire-Marty Co., Plymouth, Wis., $600 to establish an industrial fellowship for the study of factors involved in the manufacture of cheese.

National Cheese Institute, Chicago, $1,235 additional grant for studies on cheese and other dairy products.

Heyden Chemical Corporation, Garfield, N. J., $2,200 to establish an industrial fellowship in agricultural bacteriology and biochemistry.

Carnegie-Illinois Steel Corporation, Pittsburgh, $1,125 addition to industrial research fellowship for studies of dairy barns.

Parke, Davis and Company, Detroit, $2,000 for continuation of research on malaria in the department of pharmacology.

Nutrition Foundation, New York City, $6,000 for vitamin studies, a study of the relation of dental caries in the monkey and a study of biotin metabolism.

W. K. Kellogg Foundation, Battle Creek, Mich., $4,000 for loans or scholarships in the School of Nursing.

Wisconsin Alumnae Club, Minneapolis, $100 contribution to the Henrietta Wood Kessenich loan fund.

Hoberg Paper Mills, Inc., Green Bay, $250 for publication of the *Journal of Land and Public Utility Economics*.

International Harvester Company, Chicago, $500 for publication of the *Journal of Land and Public Utility Economics*.

Subscriptions to the Pro Arte fund, $2,194.

LOUISIANA STATE UNIVERSITY UNIT OF THE MILITARY GENERAL HOSPITAL

The Louisiana State University Unit, Military General Hospital Number 64, was mobilized by the Army of the United States for active war duty on July 15. The unit is composed of fifty-five physicians and dentists, 105 nurses and a large number of civilian specialists. It is organized to care for 1,000 patients in a base hospital and will be assigned to foreign duty. The unit will undergo a period of training in military hospital routine at one of the Army posts in the United States before being assigned to active service with a combat force.

The medical and nursing staff will be supplemented by the addition of some 500 enlisted personnel. All medical members of the unit hold positions on the faculty of the Louisiana State University School of Medicine.

Many members of the group were already on active duty and many others had applied for immediate active duty and were awaiting assignment when the call for mobilization of the unit was received. These members joined the unit at the port of mobilization.

The unit was organized during the summer of 1940 by Dr. Urban Maes, director of the department of surgery of the School of Medicine, who was in charge of the surgical section of Base Hospital No. 24 during World War I and who served in France.

From the time its organization was completed until its mobilization, the unit was directed by Lieutenant-Colonel Ben R. Heninger, clinical professor of medicine. On mobilization, Colonel Daniel B. Faust, of the regular Army Medical Corps, was assigned to command the unit. Lieutenant-Colonel Heninger is chief of the medical section, and Lieutenant-Colonel Charles J. Miangolarra, clinical assistant professor of surgery, is the chief of the surgical section.

SCIENTIFIC NOTES AND NEWS

Sir Henry Dale, president of the Royal Society, has been appointed chairman of the Science Committee of the British Council. He succeeds the late Sir William Bragg.

The Royal Geographical Society has awarded the Founder's Medal to Miss Freya Stark for her travels in the East, the Patron's Medal to Owen Lattimore for his travels and studies in Central Asia, and the Victoria Medal to Dr. Harold Jeffreys for his researches on the physics of the earth.

The Sociedad Mexicana de Historia Natural held a meeting at Mexico City on July 24 to receive as an honorary member Dr. Ernest Carroll Faust, professor of parasitology and acting head of the department of tropical medicine at Tulane University. He was presented by Professor Enrique Beltrań, permanent secretary of the society, and his diploma was given to him by Dr. Rodulfo Brito Foucher, president of the National University of Mexico, who presided. Professor Faust gave an address entitled "Experiences and Reminiscences of an American Medical Parasitologist."

It is stated in the *Journal* of the American Medical Association that Miss Grace Louise Ivanhoe, El Cer-

rito, who recently completed work in parasitology and tropical medicine at the School of Medicine of Tulane University of Louisiana, has been awarded the Geiger Medal for a thesis in the field of public health and sanitation. The Geiger Medal has for a number of years been presented to a graduate student on a public health problem of interest to the Southern states or countries contiguous to these states. The thesis was chiefly concerned with amebiasis.

THE doctorate of science has been conferred by the University of London on Dr. Frank Dickens, of the Imperial College of Science and Technology; on Charles Potter, of the Imperial College of Science, and on E. E. L. Dixon and C. E. Lucas, external students.

THE officers of the American Society of Plant Physiologists for the coming year, 1942–43, are: *President,* W. E. Loomis, Ames, Iowa; *Vice-president,* D. B. Anderson, Raleigh, N. C.; *Secretary-Treasurer,* P. J. Kramer, Durham, N. C.

AT the nineteenth annual meeting of the Long Island Biological Association, held at the Biological Laboratory, Cold Spring Harbor, on July 28, Dr. Robert Cushman Murphy, chairman of the department of birds of the American Museum of Natural History, was reelected president of the association.

DR. JAMES P. TOLLMAN, associate professor of clinical pathology at the College of Medicine of the University of Nebraska, has been appointed assistant dean.

DR. GERALD D. TIMMONS, formerly dean of the School of Dentistry at the University of Indiana and executive secretary of the American Dental Association, will succeed the late Dr. I. Norman Broomell as dean of the School of Dentistry at Temple University.

DR. DAVID W. E. BAIRD, JR., associate dean and associate clinical professor of medicine at the University of Oregon Medical School, Portland, has been appointed acting dean of the school during the absence of Dr. Richard B. Dillehunt, who for reasons of health has leave of absence.

DR. P. ARNE HANSEN, assistant curator of the American Type Culture Collection, has been appointed associate professor in bacteriology at the University of Maryland.

DR. EUGENE CHAN has been appointed visiting professor of ophthalmology at the Central University College of Medicine, China. During the last few years he has held the chair of ophthalmology at the West China University and has been head of the Department of Ophthalmology of the Chengtu Eye, Ear, Nose and Throat Hospital. Formerly he was a member of the Wilmer Ophthalmological Institute of the Johns Hopkins University.

DR. LUCIUS W. ELDER has been appointed director of the section of physical chemistry at the Central Research Laboratories of General Foods Corporation. Dr. Elder has been engaged in research work with the corporation since 1932.

DR. C. CARROLL SMITH recently retired as dental director of the Peoria, Ill., public schools after serving for twenty-four years.

DR. CARL OLSON, JR., research professor of veterinary science at the Massachusetts State College at Amherst, will report for active duty with the U. S. Veterinary Corps Reserve with the rank of captain. He has been granted leave of absence to serve for the duration of the war.

THE Westinghouse Electric and Manufacturing Company founded in 1939 at Mellon Institute an industrial fellowship to conduct investigational work on plastics, especially synthetic resins, for constructional purposes. Since then the fellowship staff has been carrying on research on new raw materials, new molded products and new processing methods, evaluating them for commercial application. In these activities particular emphasis has been placed on the employment of plastics in those fields where the uses of resinous materials are unknown, limited or undeveloped. Following the completion of this basic research program, two specialists, H. Ross Strohecker and William B. Johnston, will conduct the subsequent investigational and developmental work. Mr. Strohecker will give attention to the physical technology involved and Mr. Johnston will perfect the chemical processing included in the comprehensive project. They will have the direct and constant cooperation of experts in the Westinghouse organization.

PROFESSOR ROGER J. WILLIAMS, of the department of chemistry of the University of Texas, presented a series of four lectures, from July 21 to 24, under the auspices of the department of biological chemistry and the summer session at the University of Michigan. His lectures were concerned with the vitamin B complex.

THE annual meeting of the Corporation of the Marine Biological Laboratory will be held in the auditorium of the laboratory at Woods Hole, Mass., on Tuesday, August 11, at 11:30 A.M., for the election of officers and trustees and the transaction of such business as may come before the meeting.

THE American Roentgen Ray Society will hold its annual meeting at Chicago with headquarters at the Palmer House. Haddon Hall, Altantic City, where

it was originally planned to meet, has been taken over by the Government.

The twenty-second annual meeting of the Highway Research Board will be held on December 2, 3 and 4 at the Hotel Statler, St. Louis. It is expected that time and travel facilities will be conserved by holding this meeting immediately before that of the American Association of State Highway Officials, which occurs in St. Louis the following week.

The American Dietetic Association will hold its twenty-fifth annual meeting at the Hotel Statler, Detroit, from October 19 to 22. All the sessions are planned to provide the dietitian with aid under the circumstances imposed by the war. Plans for increasing the number of trained dietitians available for army service as well as for civilian service will be considered.

According to the *Journal* of the American Medical Association, an informal advisory committee for the vitamin A industry has been appointed to confer with the Office of Price Administration regarding pricing and distribution problems. The committee held its first meeting in Washington, D. C., on July 27, to discuss provisions of a proposed maximum price schedule for vitamin A oils and concentrates. The advisory panel is an outgrowth of a recent industry conference held in San Francisco between the Office of Price Administration and all branches of the industry.

A banquet in honor of forty successful candidates in the first annual science talent search of the Science Clubs of America, sponsored by Science Service, Washington, D. C., was held in Washington on July 15. Among some 11,000 entrants, all seniors in secondary schools in the United States, 3,200 completed competitive examinations and wrote essays on "How Science Can Help Win the War." Three hundred of these entrants won special recognition; 260 of them were given honorable mention and 40 were chosen to take a prize trip to Washington. Eighteen Westinghouse Science Scholarships of $200 each are awarded to members of this group who have rated high in tests and interviews held in Washington. Westinghouse Science Scholarships of $2,400 each are awarded to the boy and the girl receiving highest rating.

The Rockefeller Foundation has made a grant of £1,875 towards the expenses of the Oxford Nutrition Survey during the past year and has promised a grant of £3,000 for each of the next two years. These funds will be administered by a committee consisting of the Regius professor of medicine, the Whitley professor of biochemistry, and the Waynflete professor of physiology, Sir Robert McCarrison, Sir Wilson Jameson and Dr. H. M. Sinclair. The survey is investigating economic, dietary, clinical and biological methods of assessing nutrition in man. Besides giving training in their use it is also on behalf of the Ministry of Health examining the nutrition of samples of the population.

An Associated Press dispatch dated August 1 reports that the Battle Creek Sanitarium has now been given over to the Government and will be known as the Percy L. Jones General Hospital for war casualties. The purchase price was $2,251,100. Lieutenant Colonel Norman T. Kirk, who will be at the head of a hospital staff of 700, said that it would be remodeled into long wards accommodating 1,000 beds at the start. The first patients will arrive about October 1 from military training centers where they have contracted ailments requiring long treatment. Former guests of the sanitarium have been transferred to several large adjacent buildings to continue treatment under the direction of Dr. John H. Kellogg.

Nature states that the University of Marburg, with the support of the Behring Works, has founded an Emil von Behring prize consisting of a medal and the sum of five thousand gold marks. It will be awarded every two years for scientific work in medicine, veterinary medicine or natural science, with special reference to immunity and control of epidemics.

DISCUSSION

COLOR BLINDNESS AND BORDERLINE CASES

Never was there greater need for exact specification of the color capabilities of the normal and aberrant eye. What has psychology to offer? The term "color blindness" itself is a misnomer, misleading and unduly depressing, even when qualified by "partial." Actually, the testimony of cases of unilateral defect or of retinal islands of partial deficiency, as well as the evidence from the outer zones of normal retinae, indicates that in ordinary red-green "blindness" color is visible throughout the spectrum—blues and yellows in varying chromas and brightnesses (with a possible gray line at about 500 mμ).

Evidence, further, is steadily piling up of the frequency of "color weakness" and the various "anomalies" in which all four primaries and their derivatives are visible, though with the R–G pair weakened, sometimes unequally[1] (*5*, 661–702). Whether one of the pair is ever completely suppressed

[1] J. H. Nelson, "Anomalous Trichromatism," *Proceedings* Physical Society, London, 50, pp. 661–702, 1938.

without the other remains unproven. Numerous borderline cases have emerged, whether of super- or sub-sensititivity is undetermined. They fit no rubrics, and await exact measurement, for the physicist's classes, protanomalous and deuteranomalous, are purely theoretical, not descriptive. The Nagel anomaloscope and the Rayleigh equation ($xR + yG = zY$) fail to show whether one component hue is weakened or the other intensified.

What analytical test procedures are available for mass measurements of the population? For speed, the clinician leans to the *pseudoisochromatic* group: Stilling, Ishihara, Schaaff, Edridge-Green, Jensen, Rabkin—German, Japanese, French, English, American, Russian—plates displaying mosaics of color dots on a white ground, with digits or geometric figures in confusion colors. But digits (used in the first two) are unequally legible, easily confusable, dependent on accuracy of refraction and acuity and readily memorizable. True, the eighth edition of the Ishihara (following criticism in 1935 and careless publication of keys to its plates) has sidestepped some of its earlier shortcomings. But its 30 inches distance is inconvenient and ignored, throwing designs out of gear by projecting them on unintended retinal areas. It discards color-weak along with color-blind through its use of moderate chromas only, and some of its designs fail to function as expected, owing possibly to the blue-weakness of the Oriental eye; *e.g.*, the B and G digits of the familiar reversible design are misread by 25 per cent. of normals.

In certain Ishihara plates critical colors are cunningly interwoven to read one way to one type of eye, another way to another. But in the case of the plates diagnostic of so-called "red" and "green" blindness, designed to throw all cases into one or the other class according as they report the right or left digit, purplish or red—a considerable per cent. of "color blinds" read *both* or neither.

On most of the Japanese plates, however, something can be distinguished, whereas the spirits of the examinee sink steadily as blank plate after blank plate of the Stilling passes. True, the last edition of this German test, revised by Hertel, has copied some of the novelties of the Oriental and inserted a pair of diagnostic plates in R and purplish R. It contains also plates for B–Y deficiency. But the instructions are intricate and unintelligible in translation, and usually ignored by the examiner. Total scores in both the Stilling and the Ishihara are frequently misleading as to the gravity of the defect.

Combined use of the Ishihara with a few Stilling plates and Schaaff or Rabkin was recommended in 1937 by the British expert, Mary Collins,[2] for preliminary segregation of "dangerous" color defectives. But war conditions have now cut off foreign editions. In 1939–40, to meet the emergency, an improved pseudoisochromatic test set was projected by the writer, but no printing-ink firm would guarantee the chromas and hues demanded. In 1940 the American Optical Company undertook to reproduce the most useful Ishihara and Stilling plates, but the critical chromas are often weak, the hues divergent (in the sample set examined by the writer), hence reasoning from the results of the older tests is unsafe, and no standardization of the new has to date been offered.

The Inter-Society Color Council in 1941, at the request of industrialists and clinicians, started work on a color discrimination test. Following the lead of the National Institute of Industrial Psychology of Great Britain,[3] who devised lacquered disks in R, B and Y chroma series in 1926 for serial grading and matching, R and RP series of glossy plastic chips in matched pairs, with many closely graded chromas steps from grey to medium saturation have been produced, and standardization of a "color aptitude" test is under way.

Industry meanwhile has taken the lead over psychological laboratories. The Institute of Paper Chemistry has devised its own matching tests, and the American Paper and Pulp Association has issued a monograph with many tables and curves for confusion colors.[4]

Convinced that only analytical study of thresholds of a number of hues will solve the enigmas of color vision, the writer is employing seven series of matched Munsell paper: R, B, G, BG and B chromas, and short strips of the special research 100-hue equal-chromas-and-value circle in the R's and G's, in conjunction with spectrometer and adaptometer observations. From the results, distribution curves will be plotted for color sensitivity in normal and aberrant; and the hypothesis that all degrees of sensitivity to the primaries link the congenital "color blind" with the normal-visioned be demonstrated or discredited.

Meanwhile the laboratory worker suggests that the psychologist, after consulting his Greek dictionary, scrap the non-descriptive and misleading rubrics of protanopia and deuteranopia and their derivatives, foisted on us in 1897 by the hasty generalizations and faulty experimental procedures of von Kries;[5] disavowed in 1932 by the eminent British authority on light, R. A. Houstoun,[6] and the source to-day of endless confusion and distortion of experimental observa-

[2] M. Collins, *Nature* (London), 140: 532–34 and 569–76, 1937.

[3] W. O'D. Pierce, "The Selection of Colour Workers." London: Isaac Pitman and Sons, 1934.

[4] American Paper and Pulp Association, "Color Blindness." Appleton, Wisconsin, 1941.

[5] E. Murray, *Am. Jour. Psychol.*, 42: 117–127, 1930.

[6] R. A. Houstoun, "Vision and Colour Vision." London: Longmans, Green and Company, 1932.

tions. The old term "color blind" may well go with them.

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WARTIME SCIENTIFIC MANPOWER PRODUCTION

IN recent numbers of SCIENCE[1] there have appeared communications which manifest the growing demand for complete utilization of scientifically trained personnel. Through the facilities provided by the National Roster of Scientific and Specialized Personnel studies of the problems associated with utilization and assignment have been and are being studied and allocations are being made in various fields of science. The Roster is not simply an organized card file; it is proceeding as rapidly as possible in determining needs and allocating supply.

The problem it is considering at present is the mechanism by which we can supplement dwindling reserves in scientifically trained men. The process of robbing the universities to supply technically trained manpower has been carried to dangerous limits which, if pursued further, will result in the elimination of the future supply. The war has now progressed a sufficient length of time for us to realize that temporary expedients are not sufficient and that a long-range view will be necessary for the continuous replacement of scientific personnel which must be accomplished if we are to win this war.

The period of temporary expedients has enlisted the services of too great a number of scientists who are now removed from their main purpose of producing an adequate supply for future needs. This situation is inevitable at the beginning of an emergency but must now receive the thought and planning necessary for its correction.

The pressure of public and professional opinion must be impressed upon the individual to make each think of the best that he can produce for the total national good. This involves a critical self-analysis removed from social and patriotic glamor motives which almost inevitably sway the principles on which such a decision must be made. This inventory of service should have as its keystone the idea of production of an increasingly large number of scientific personnel. The schools, colleges and universities have compacted and revised their conventionalized schedules to make possible the earlier and steadier training which should produce new scientifically trained men in the minimum time and at that age when their scientific knowledge is most easily adapted to the armed services.

This war is dominantly one of ideas. It can be successfully waged only by the complete use of brains and technological *knowledge* combined with mechanical instruments of war. Peace-time methods impose artificial limitations upon production of new scientists which in view of the continuing urgency must be removed. Independence of thought and action form a requisite part of any such program—each man represents a newly modified model as he leaves the academic production line. On that production line must be applied the most skilful teaching which science has ever had. Formulae which have been rigidly adhered to must be reevaluated and discarded if they can not be fitted to new conditions. Each man on the instruction assembly line must treat his product with respect to its own particular idiosyncrasies—the assembly line expert will not exercise his own. Standards and inspections must be rigid with a degree of flexibility at all other points. It is here that real teachers are needed, and it is here that the common methods of rote instruction must give way.

Standardization of many science courses has proceeded almost to the point of freezing their content and the methods of approach. This process must be revised and unfrozen in every case in which the new needs are evaluated in the light of increased production. Emphasis must be reapplied. To-day as never before broad and fundamental patterns of factual synthesis must be placed before the receptive minds which are to be scientifically trained.

The personal inventory mentioned above must be made in the light of this statement. The breach in curricular walls and the abolition of conventional schedules have left many an academic scientist in a state of emotional upheaval resulting in a sense of lost personal security. The insecurity so produced has immediately been transferred according to a principle of human nature which antedates scientific technology, for in times like these other pastures always appear greener and old responsibilities can always be sidetracked by the assumption of new ones. It is this factor which makes many scientists feel that they should be actively engaged in war work of a recognized variety when deep in their hearts they realize that their duties in their own environment are much more important to national welfare. It is harder to fight on the home front without official recognition than to transfer to other and perhaps different fields in which service may be less effective.

The universities have taken the only standpoint that could be taken in this emergency: they have unstintingly contributed their manpower and laboratory facilities. They too, must recognize that their essential purpose in national welfare is production of an increasing number of men trained to think. They must conserve their teaching manpower if this is to succeed.

The devastation of science departments by armed

[1] SCIENCE, 95: 2472, 507–8, May 15, 1942; *Ibid.*, 96: 2479, 16, July 3, 1942.

and governmental services must be rigidly scrutinized in the light of necessity. The resultant deterioration which shows absence of planning and foresight must not be allowed to continue. The universities' own needs must be weighed against other demands. The efficient future control of the destiny of the universities themselves requires the replacement of scientific manpower. These replacements must be accelerated both in tempo and quantity while quality must be maintained. The colleges and universities can play their part only by keeping active staffs intact and maintaining the morale of their teachers by recognizing this as a dominant part of the war effort.

JOHN S. NICHOLAS,
National Research Council Representative on the National Roster of Scientific and Specialized Personnel

RUSSIAN-ENGLISH TECHNICAL DICTIONARY

THERE is an urgent demand at the present time for an up-to-date Russian-English dictionary of scientific and technical terms. It is known that a number of Russian-English glossaries of specific terms have been compiled by various scientific institutions and individuals, and it is thought that it would be extremely helpful to scientists and technical translators if copies of these glossaries could be collected together and placed in the Science Library in London where one complete set could be consulted.

Will, therefore, any institution or individual who has compiled a glossary of Russian scientific or technical terms, whether printed or in MS, please send a copy to the Secretary, Anglo-Soviet Scientific Collaboration Sub-Committee, The British Council, 3 Hanover Street, W.1, London, England, who will collect these for the Science Library.

It is hoped at a later stage to compile a large dictionary, but the immediate aim is to collect the different glossaries in one place where they can be consulted. Each glossary will be known by the name of its compiler.

E. J. RUSSELL,
Chairman, Anglo-Soviet Scientific Collaboration Sub-Committee

SCIENTIFIC BOOKS

LEUKEMIA IN ANIMALS

Spontaneous and Experimental Leukemia in Animals. By JULIUS ENGELBRETH-HOLM. 245 pages, 44 figures. Edinburgh and London: Oliver and Boyd. 1942.

THIS book of Engelbreth-Holm, published under the auspices of the Lady Tata Memorial Trust, is an authoritative and timely monograph. Leukemia, a cancer-like disease of the blood cell-forming organs, was little known until recent developments, reviewed in this book, focused the attention of increasing numbers of scientists and laymen on this disease. Leukemia is not an uncommon disease, and its incidence is seemingly rising. It arouses concern because it affects persons, young and old, who are often healthy in appearance, and the disease often follows a course of many years free of all symptoms, though it is rapidly fatal in many instances. Research men are being attracted to its study by the many avenues of investigation opened recently, making it possible to explore diverse problems of interest and significance. More than the importance of this disease itself, the hope that leukemia research will contribute to the understanding of cancer has induced most of our cancer research foundations and the National Cancer Institute to place it on their program.

The first part of the book is devoted to a historical survey of this disease, first recognized about one hundred years ago, and to a description of its occurrence and of its varied manifestations in different species of animals which contributed much to our knowledge of this disease and laid the foundation for experimental work.

The modern period of experimental leukemia dates back to 1908, when a Danish investigator, Ellermann, discovered the causation of avian leukemia by a filterable agent (virus). The discovery of Peyton Rous that chicken tumors are produced by viruses followed shortly and opened a productive period of research, during which chicken tumors and chicken leukoses and their causative filterable agents have been extensively investigated. Some twenty years later the transplantability of different mammalian leukemias was discovered. Engelbreth-Holm is among the pioneers who investigated the many problems of avian leukosis offered by the discoveries of his countryman, Ellermann; later he also contributed to the knowledge of mammalian leukemia. With the skill of a good teacher he sketches in this book the history and present status of leukemia research in a manner easily understandable to those not familiar with this disease. With the authority of an investigator he introduces research workers into the intricacies of newer knowledge, giving precise and complete reference to original articles. The field is covered in a systematic manner, and the book closes with a discussion of the nature of human and mammalian leukemia.

It is still not generally conceded that leukemia is

a type of cancer, but the evidence detailed in this monograph in favor of this view is overwhelming. The fact that some leukemias may be caused by a virus no longer opposes this view, for both typical avian and mammalian tumors are now known to be caused by viruses, even though the infectiousness of these viruses is obscure and their relation to viruses producing infectious diseases is subject to controversy. Such problems are treated objectively by Engelbreth-Holm. Although he was the first to publish experiments suggesting that mammalian leukemia (that of the mouse) is produced by a virus, the contradictory publications and criticisms are so thoroughly discussed as to take the pen away from those who are about to attack his views.

The gap between sarcoma and leukemia has been solidly bridged by studies of the avian disease through the finding of viruses which are capable of producing both diseases. Each of these viruses has distinctive features of its own characterized by specific cell affinities which seldom if ever change. The publications of Duran-Reynals which have recently shaken our belief in the specificity of these viruses have apparently appeared in print after the completion of this monograph.

In a field as new as this there are many avenues of research merely sketched by observations, many of which are of preliminary character. By discussing these observations at length, the text becomes vivid but open to controversy. I shall comment upon a few of these.

The significance of the "milk influence" of breast cancer is fully grasped by the author, and his assumption that it is a virus is well supported by more recent data. Credit for this discovery of great promise should have been given more clearly to Bittner and Little. As regards the existence of a similar influence on leukemia, the negative foster-nursing experiments of MacDowell and Richter and of Engelbreth-Holm are cited, but these findings have since been contradicted by others, including MacDowell. The newer studies indicate that the incidence of leukemia is likewise influenced by foster-nursing, even though this influence has not been shown to pass to the second generation as does the breast carcinoma influence.

Concerning the heredity in spontaneous leukemia, the controversial findings of MacDowell and of Slye are fully stated and the findings of the former are accepted as the rule. Again, more recent data and a reconsideration of all published studies in this field indicate that there is no single law of inheritance of leukemia. This varies with different stocks but is constant for each.

Immunity phenomena in transmissible leukemia are reviewed in great detail. The pattern of this research is similar to that developed years ago with common transmissible tumors, and in the opinion of the reviewer many of these studies have not been found to apply to the natural disease. There are exceptions, such as the possibility of influencing the incidence of spontaneous leukemia by immunization. The transfer of immunity to leukemia by grafts or injections of splenic or liver tissue from immunized animals should be of great interest also to immunologists. The suggestive finding that the growth of highly virulent cells is retarded by immunization with embryonal tisues while the growth of slightly virulent cells is accelerated may serve to explain some anatomical manifestations of leukemia. Lymphosarcoma, long classified as a tumor, is considered as leukemia held in check by immune bodies. It is highly desirable to lay a more solid foundation to these suggestions. If confirmed, the question should be answered whether these findings with transmitted leukemia are applicable to the spontaneous disease. Certainly malignant tumors proliferate until the host is destroyed; whether they engender the formation of antibodies at all and, if so, how these antibodies modify the course of a neoplastic disease remain to be elucidated.

The experimental production of leukemia, an accomplishment of the past few years, is thoroughly surveyed. Certain agents, such as carcinogenic hydrocarbons, estrogens and x-rays, are powerful "leukemogens," even though their action is influenced by hereditary factors; the leukemogenic action of cell-free extracts of leukemic tissues or of embryonal tissues is still shrouded in mystery. But knowledge is accumulating on both hereditary and environmental factors, and this may ultimately lead to an understanding of the genesis of spontaneous leukemia.

The scope of leukemia research is beyond that of a neoplastic disease. A perusal of this book shows how the metabolism studies of leukemic nodes disclosed novel phenomena of special interest to those concerned with tissue metabolism in general, such as the influence of host factors upon the metabolism of malignant cells, certain preleukemic metabolic changes and the possible existence of an inhibitor of anaerobic glycolysis circulating in blood of leukemic animals. Although there are many obscure points concerning these studies, they are highly stimulating. The investigations with x-rays and radio-active substances should be of special concern to those interested in radiobiology of malignant tissues, and the heredity studies to those concerned with mammalian genetics. The latter show, under carefully controlled conditions, how known and unknown extrinsic factors modify hereditary tendencies, obscuring the recognition of the precise laws of inheritance of a neoplastic disease. Certain immunity studies, even if referred to by some scholars of cancer as mere "intellectual gymnastics," should be of great interest to those concerned with

the laws of survival of tissue grafts or with individual differentials, and certainly to all immunologists.

The high standard of production of this book is complimentary to the publisher and editors, and much of its contents to research men in this country. Among the latter E. C. MacDowell and associates of the Carnegie Institute deserve special mention for their large share in recent contributions.

JACOB FURTH

CORNELL UNIVERSITY MEDICAL COLLEGE

SOCIETIES AND MEETINGS

THE AMERICAN DIABETES ASSOCIATION

THE American Diabetes Association, a new organization founded in 1940, held its first annual meeting in Cleveland on June 1, 1941, the official family including Honorary President Elliott P. Joslin, President Cecil Striker, First Vice-President Herman O. Mosenthal and others prominent in the field of diabetes. Active members are physicians, but all interested in the aims of the association are eligible for election as associate members. It is dedicated to the problems of the diabetic, medical, social and economic, and aims to elevate standards of medical treatment by dissemination of the knowledge of diabetes, coordination of activities of associated groups, collection and publication of statistical data and encouragement of research in all phases of the subject. A volume has been issued containing the proceedings of the meeting.

This volume includes a secretarial report by Samuel S. Altshuler, Detroit; a presidential address by Cecil Striker, Cincinnati; "Sir Frederick Banting," by C. H. Best, Toronto (reprinted from SCIENCE, 93: 243, 1941); an address by Elliott P. Joslin, Boston, "Diabetes Yesterday, Today and Tomorrow"; and papers on "The Prevention of Diabetes," by R. E. Haist and C. H. Best, Toronto; "The Etiology of Diabetic Acidosis," by Arthur Mirsky, Cincinnati; "Comments on Nutritional Requirements," by Russell M. Wilder, Rochester, Minnesota; "Standards of Diabetic Therapy," by Herman O. Mosenthal, New York City, and "Avoidance of Degenerative Lesions in Diabetes Mellitus," by Julian D. Boyd, Robert L. Jackson and James H. Allen, Iowa City.

Haist and Best report that degenerative lesions of the pancreatic islets and the resultant diabetes which occur in dogs during administrations of sufficient doses of pituitary extract (Houssay-Young) can be prevented by diets low in carbohydrate and high in fat with supplementary insulin administration and suggest trial of the method in incipient human diabetes. Wilder draws attention to conclusions of the Committee on Food and Nutrition of the National Research Council as to vitamin requirements of normal diets and suggests that they be considered in prescribing diets for diabetics. Mirsky reviews the history of the conception that ketosis in diabetes depends on a limitation of glucose oxidation, contending that it depends rather on a limitation of storage as glycogen in the liver. Mosenthal asks for a revision of the doctrine that any elevation of the blood sugar concentration above the norm is necessarily to be combatted in all types and degrees of diabetes, and brings evidence to show that it is better ignored in some situations. Boyd, Jackson and Allen support the proposition that degenerative sequelae of diabetes (cataracts, arteriosclerosis, etc.) are late results of inadequate control of the diabetes, a view not shared by many writers. The discussion of all papers which are exceptionally full and illuminating lead to a harmonization of a number of erstwhile variant views.

R. T. WOODYATT

CHICAGO

REPORTS

PROJECT GRANTS OF THE GEOLOGICAL SOCIETY OF AMERICA

THE Council of the Geological Society of America has authorized the following project grants:

General Structure, Geomorphology and Stratigraphy—$2,950.

F. J. Pettijohn, University of Chicago, will spend six weeks in a detailed study of the Huronian-Archean contact in the Menominee and Calumet districts of Michigan. Preliminary study of basal conglomerates has proven the pre-Huronian age of the granite northeast of the Menominee. It is proposed to extend this work into the Calumet district, where post-Huronian granites are reported, in order to differentiate the two granites. $200.

Lowell R. Laudon, University of Kansas, will complete a five-year study of the stratigraphy of the Mississippian of New Mexico. The contribution to the stratigraphy and geologic history of New Mexico will also make possible a comparison with the Mississippian of the upper Mississippi Valley and the Rocky Mountain province. $250.

Paul A. Siple, United States Antarctic Service, Miami University, Ohio, will construct several large-scale maps of the Bay of Whales region of Ross Shelf Ice, Antarctica, from oblique photographs taken by the Byrd Antarctic Expeditions of 1929 and 1934 and the United States Antarctic Service in 1940. The maps will serve as a basis for determining quantitative deformation of the ice, and model theory suggests that further detailed studies will

contribute to understanding tectonic features of the earth's crust. $1,500.

H. E. Wood, 2nd, University of Newark, as chairman of a committee of the Society of Vertebrate Paleontology, will select copy for and supervise preparation of a series of colored plates representing important type localities or significant described sections to accompany a paper on the Continental Tertiary of the Rocky Mountains and High Plains. The project will provide a test of the value of colored plates as a tool for the use of stratigraphers. $1,000.

Paleontology—$1,135.

Claude W. Hibbard, University of Kansas, will collect Pliocene and Pleistocene vertebrate fossils from unconsolidated gravels in Clark County, southwestern Kansas, in extension of six seasons of field work in adjacent counties. The gravels of fossiliferous beds are put through screens of proper size to recover small fragments and teeth. The work to date has produced four new High Plains Pliocene and Pleistocene vertebrate fossils, descriptions of which have been published. $450.

M. K. Elias, State Geological Survey of Nebraska, will spend six weeks in central Colorado collecting the Walchia flora from lower Pennsylvanian rocks. Walchia was formerly regarded as a Permian plant, and the beds that Elias will study are the oldest conifer-bearing beds known. $325.

Robert G. Chaffee, Academy of Natural Sciences, Philadelphia, will set up an inter-museum card catalogue of vertebrate paleontolgical specimens of North America. $360.

Geophysics—$4,700.

N. B. Keevil, Department of Physics, University of Toronto, will study the distribution of radiogenic heat in North American granitic rocks. Radioactivity measurements are made, and a rapid method of requisite accuracy is being developed from previous work upon 1,000 rocks. Representative specimens will be obtained from geological surveys, universities, museums and mining companies. The project will provide a reliable average value for the rate of production of radioactive heat in North American granitic rocks and determine the extent of regional geothermal anomalies on this continent. $2,500.

G. P. Woollard, Princeton, New Jersey, will continue his investigation of the subsurface geological conditions along the eastern seaboard by a magnetic and gravitational survey. The survey to date has extended from New England to Washington and will now be extended to Florida. Reports on the transcontinental survey in 1940 and the more detailed examination along the northeastern seaboard in 1941 are in hand for early publication. $2,200.

Economic Geology—$400.

John S. Brown, Balmat, New York, will study the relation of porosity to ore deposition in the metamorphosed Grenville limestone of St. Lawrence County, New York. Porosities of diamond drill cores have been determined, and Dr. Brown will now carry out a thin-section study of the same cores to determine the size of openings. A preliminary report has been published in Technical Paper 1194, American Institute of Mining and Metallurgical Engineers, "Factors of Composition and Porosity in Lead-Zinc Replacements of Metamorphosed Limestone." $400.

Glacial Geology—$140.

Chauncey D. Holmes, University of Missouri, will make a detailed study of glacial transport and progressive changes in the shape of tillstones of known origin in west-central New York. The region is especially favorable for the study because the glacial ice moved at right angles to the strike of lithologically distinctive formations. The study was begun in 1937, and two papers have been published, one in the *American Journal of Science* and one in the *Bulletin of The Geological Society of America.* $140.

SPECIAL ARTICLES

THE "SULFANILAMIDE EFFECT" OF SUBSTANCES DEVOID OF SULFO GROUPS

Sulfanilamide and its derivatives reduce *in vitro* the speed of bacterial growth; complete bacteriostasis is attained as the maximal effect.[1] The effect of sulfanilamides is inhibited by p-aminobenzoic acid.[2] The efficiency of sulfanilamides is explained by their structural similarity to p-aminobenzoic acid; they displace this "essential metabolite"[3] or "growth factor"[4,5] from its enzyme's surface. The competition of essential metabolites of the carbonic acid type with analogous sulfonic acid compounds has been demonstrated by McIlwain, applying nicotinic acid amide ⇆ pyridin-3-sulfonic acid amide[6] and α-amino acids ⇆ α-amino sulfonic acids,[7] further by Kuhn, Wieland and Möller[8] with pantothenic acid ⇆ sulfopantothenic acid. The following two observations demonstrate that analogous substances devoid of sulfo groups are also able to displace p-aminobenzoic acid.

(1) The Antibacterial Effect of p-Aminobenzamide and Its Inhibition by p-Aminobenzoic Acid

Material for inoculation: 24 hours culture of *B. coli*

[1] J. Hirsch, in press.

[2] D. D. Woods, *Brit. Jour. Exp. Path.*, 21: 74, 1940.

[3] P. Fildes, *Lancet*, 1: 955, 1940.

[4] S. D. Rubbo and J. M. Gillespie, *Nature*, 146: 838, 1940.

[5] R. Kuhn and K. Schwarz, *Ber. Deuts. Chem. Ges.*, 74: 1617, 1941.

[6] H. McIlwain, *Brit. Jour. Exp. Path.*, 21: 136, 1940.

[7] H. McIlwain, *ibid.*, 22: 148, 1941.

[8] R. Kuhn, Th. Wieland and E. F. Möller, *Ber. Deuts. Chem. Ges.*, 74: 1605, 1941.

TABLE 1

	Test-tube No.	1	2	3	4	5	6	7
	Inoculation per 5 ml	1	$\frac{1}{10}$	$\frac{1}{10}2$	$\frac{1}{10}3$	$\frac{1}{10}4$	$\frac{1}{10}5$	$\frac{1}{10}6$ drop
		Growth after 43 hours at 37° C						
a	Control	+	+	+	+	+	+	–
b	p–Aminobenzamide ... 1.10^{-3}M	+	+	–	–	–	–	–
b′	p–Aminobenzamide ... 1.10^{-3}M; p–Aminobenzoic acid ... 1.10^{-4}M	+	+	+	+	+	+	+
c	Sulfanilamide ... 1.10^{-3}M	+	–	–	–	–	–	–
c′	Sulfanilamide ... 1.10^{-3}M; p–Aminobenzoic acid ... 1.10^{-4}M	+	+	+	+	+	+	–

on a synthetic medium for staphylococci.[9] Medium: 10.53 per cent. of ammonium chloride, 0.3 per cent. of glucose, 0.5 per cent. of sodium sulfate, 0.01 per cent. of magnesium chloride, phosphate buffer (M/15) pH 7.2; each 5 ml.

The bacteriostatic effect of p-aminobenzamide is almost as strong as that of equimolecular quantities of sulfanilamide; both effects are suppressed by p-aminobenzoic acid.

(2) THE ANTIBACTERIAL EFFECT OF P-AMINOPHENYLARSINIC ACID (ATOXYL) AND ITS INHIBITION BY P-AMINOBENZOIC ACID

Atoxyl reduces the speed of bacterial growth, but no complete bacteriostasis is attained. The speed of bacterial growth in aerobic cultures has been determined by continuous measurement of the oxygen consumption in Warburg vessels.[10]

Material for inoculation: 13 hours culture of *B. coli* on a synthetic medium;[9] one drop per 30 ml was inoculated in the same medium.

TABLE 2

Culture No.	I	II	III	IV	V	VI
Addition	–	–	Atoxyl 1.10^{-1}M		Atoxyl 1.10^{-1}M; p–Aminobenzoic acid 1.10^{-4}M	
Hours after inoculation	mm³ Oxygen consumption per ml in 30 minutes					
3 00	4	4	2	3	6	4
3 30	11	9	7	7	13	11
4 00	23	20	13	13	28	26
4 30	51	40	20	20	49	46
5 02	91	70	30	28	76	75
5 34	126	115	37	38	103	99

p-Aminophenylarsinic acid (atoxyl) acts in the same way but decidedly weaker than sulfanilamide and p-aminobenzamide. This corresponds to the lesser antibacterial efficiency of free sulfanilic acid.

Among the derivatives of p-aminobenzamide possibly a further new group of substances with chemotherapeutic effects towards bacterial infections might be found. Other substances, too, devoid of sulfo groups, but structurally related to p-aminobenzoic acid, should be tested with regard to their chemotherapeutic effects.

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[9] P. Fildes and G. M. Richardson, *Brit. Jour. Exp. Path.*, 18: 292, 1937.

[10] J. Hirsch, *Enzymologia*, 4: 94, 1937.

ENZYME ACTION

JUST as the adsorptive capacity of finely ground activated charcoal for methylene blue is decreased by narcotics, so it appears that the activity of enzymes is reduced similarly by the same narcotics.

In plant physiology there is an experiment whose object is adsorption and whose procedure involves the mixing of finely ground activated charcoal with an aqueous solution of methylene blue. Under the correct proportion which varies with the concentration of methylene blue and the adsorptive potency of the finely ground activated charcoal, the filtrate is clear and devoid of methylene blue. The conclusion is that the methylene blue has been adsorbed by the finely ground activated charcoal. The experiment also directs the students to add ethyl alcohol to the residue, whereupon the filtrate becomes deep blue and the conclusion is that alcohol decreases the adsorptive capacity of the charcoal particles.

The students in plant physiology at the University of South Dakota performed this experiment in January, 1942, shortly after the meetings of the American Association for the Advancement of Science in Dallas, and when the prize-winning paper was still fresh in my mind. As most of you may recall, the prize was awarded to Johnson, Brown and Marsland for the paper entitled "The Mechanism of Temperature and Hydrostatic Pressure Reversal of Narcosis in Luminous Bacteria."[1] The research involved the action of narcotics on luciferase, the enzyme which is responsible for luminescence in luminous bacteria. The investigators found that narcotics readily reduce the intensity of luminescence, clearly indicating a decrease in enzymatic activity.

[1] Frank H. Johnson, Dugald E. S. Brown and Douglas A. Marsland, *Anat. Rec.*, 81: 4, Supplement, page 33, 1941.

The experiment in plant physiology dealing with adsorption brought to my mind this fundamental question when the experiment was being discussed with the students. If ethyl alcohol reduces the adsorptive capacity of charcoal particles for methylene blue, will ether, chloroform, barbital and sulfanilamide have the same effect? Preliminary tests did show that each drug separately reduced the adsorptive capacity of charcoal particles for methylene blue.

Other tests to determine the threshold value of each drug followed. The threshold value is the maximum amount of drug which will not produce any decrease in adsorption. Less amounts have no apparent effect and larger amounts affect the adsorption progressively more. One gram of the finely ground charcoal[2] on hand in the botany laboratory was found to adsorb all the methylene blue from 13 ml of a 1 per cent. aqueous solution but no more. With this set-up it was rather simple to determine the threshold value for each drug. A standard mixture of one gram of charcoal particles and 13 ml of the 1 per cent. aqueous methylene blue with the addition of slightly more than the threshold value of a certain drug would produce a blue filtrate upon filtration.

The threshold values for a number of narcotics are given in Table 1. The concentration value is based on the total amount of mixture, which in every case was 100 ml. The temperature was close to 25° C.

TABLE 1

THE THRESHOLD VALUES FOR SOME NARCOTICS WHICH AFFECT THE ADSORPTIVE POTENCY OF ACTIVATED CHARCOAL PARTICLES FOR METHYLENE BLUE

Narcotic	Threshold value based on amount in total mixture (100 ml)
Ethyl alcohol	8 per cent.
Ether	1 " "
Chloroform	0.5 " "
Sodium barbital	0.1 " "
Sulfanilamide	0.025 " "
Saponin	0.06 " "

Table 2 presents data dealing with the effect of the narcotics on the action of diastase. In every case 10 ml of 1 per cent. soluble starch, 1 ml of a 1 per cent. diastase solution and enough narcotic to give the stated concentration were diluted to 20 ml. The concentration for each narcotic is based on the final solution volume of 20 ml. The temperature was close to 25° C.

TABLE 2

THE EFFECT OF SOME NARCOTICS ON THE DIGESTIVE ACTION OF DIASTASE

Narcotic and its concentration	Minimum time for soluble starch solution to be digested past the last iodine staining stage
Control (no narcotic added)	15 minutes
Ethyl alcohol 25 per cent.	30 "
Chloroform 25 per cent.	25 "
Saponin 0.25 per cent.	25–30 "
Sodium barbital 0.25 per cent.	180 "[a]
Sodium barbital 0.10 per cent.	70 "
Sulfanilamide 0.25 per cent.	20 "[b]

a. Retarded 165 minutes; b. Retarded 5 minutes.

It is most interesting to note the differential effects of sulfanilamide on charcoal particles and diastase. While sulfanilamide is extremely potent in its effect on the adsorption of methylene blue by charcoal particles, it is only mildly effective in arresting the digestive action of diastase on soluble starch. This difference may be fundamental in explaining why sulfanilamide is so effective in combating body pathogens without critically and dangerously upsetting the regular essential metabolic activities of the host's body. To be exact, sulfanilamide is about four times as potent as sodium barbital in reducing the adsorptive capacity of charcoal particles for methylene blue, but only one thirty-third as drastic as sodium barbital in its retardation of diastatic action on soluble starch.

That enzyme action is adsorptive becomes even more certain when one finds that the effect of ether, alcohol and chloroform on the adsorptive potency of charcoal particles for methylene blue is canceled wholly or in part by the application of hydrostatic pressure. This is exactly what Johnson, Brown and Marsland reported for luciferase in luminous bacteria.

The action of narcotics on diastase appears to be the same as that on charcoal particles, which unquestionably had their adsorptive capacity for methylene blue reduced thereby. It may, therefore, be concluded that enzyme action is fundamentally an adsorptive process. The doubt in the minds of Johnson, Brown and Marsland as to whether the effect of barbital, sulfanilamide and p-aminobenzoic acid was chemical or adsorptive can now be removed.

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[2] Charcoal, activated, for decolorizing, about 80 mesh. Will Corporation, Rochester, N. Y.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE CHEMICAL COMPOSITION OF LIVER PREPARATIONS

Since the discovery, about fifteen years ago, of the curative action of liver in pernicious anemia, much has been learned of the nature of the active substance and the procedures for extraction.

Methods for extraction and analytical results, including my own studies, have been published else-

where.[1] From one kilogram of fresh liver I obtained 5.8 grams of yellowish brown powder as a silver salt. From the analytical results the presence of three free COOH groups, eighteen –CO–NH– groups and a molecular weight of approximately 10,000 was deduced.

Dakin and West[2] separated the inactive part with ammonium sulfate, magnesium sulfate and sodium chloride, and finally precipitated the active part with Reinecke salt. In this way they obtained a compound constituting 1 per cent. of the original dried weight and with a nitrogen content of 15.3 per cent., which they treated as a polypeptide and glucosamine. In a later publication Dakin, Ungley and West,[3] by a more refined method of extraction, obtained a fraction with 16.2 per cent. nitrogen which is characteristic of an albumose type, without glucosamine, and established a molecular weight of 3–5000. Sladek, Savczycka and Lipschuetz[4] demonstrated the old thesis that free amino groups derived from amino acids exist. Subbarow, Jacobsen and Prochownick[5] have isolated 2 milligrams of a crystalline sulfate from 100 grams of liver, a product which seems to be identical with that described by Lalund and Klemm.[6] Karrer, Frei and Fritsche[7] found in the active fraction a pentose and adenin, and believe that the activity is proportional to the phosphorus content, obtaining a maximum of 3.8 per cent. P.

In 1939 I began some new experiments. The extraction and purification methods were simplified. Each kilogram of milled liver was extracted with one-third volume of water and 6 cc of 20 per cent. sulfuric acid at 35° C. After pressing, this process was repeated at 50° C, 60° C and 70° C. The expressed liquids were mixed together and treated with $Ba(OH)_2$ at 50° C until a pH of 6.5–6.7 was obtained, warmed to 60° C and filtered. After concentrating in vacuum to one seventh of its volume at 40° C, 99 per cent. alcohol was added until an alcohol concentration of 70 per cent. was reached. After filtering and evaporating the alcohol (in vacuum at 40° C) the liquid was concentrated to half its volume, filtered and precipitated with $AgNO_3$. This salt was decomposed with HCl, filtered, and the solution precipitated with alcohol. The precipitate was dissolved in N/10 NaOH to pH 7.2 and with silver nitrate a new silver salt is isolated which has the following composition:

C	67.50	per cent.
H	6.41	" "
O	4.60	" "
N total	14.40	" "
N amino	1.40	" "
S	0.99	" "
P	1.06	" "
Ag	5.04	" "

The acid part of the substance had a molecular weight of 6,000. It contained three free COOH groups, as did the product obtained several years ago. Remaining are six free amino groups, this number increasing to eighteen after hydrolysis (5 hours of ebullition with HCl or 25 per cent.). From this the presence of twelve bonds of –CO–NH– is deduced. One kilogram of fresh liver gave 2.09 grams of this substance which was extraordinarily active in clinical tests.

For an approximate estimation of the potency of liver extracts the combination of the chemical method (fractional precipitation with alcohol) of Schales[8] and my biological test,[9] based on the influence of phenylhydrazine anemia, was found satisfactory. The results were confirmed by the clinical test of the reticulocyte response.

SUMMARY

For the present we can entertain the following ideas regarding the chemical structure of the active fraction of liver in pernicious anemia: it is an amino acid complex with three free COOH groups, it contains sulfur and phosphorus, is soluble in water, acids and bases, precipitates in alcohol at concentration greater than 87 per cent., and has a molecular weight of 6,000.

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[1] Erdos, *Biochem. Zeitschr.*, 277: 337, 1935.
[2] Dakin and West, *Jour. Biol. Chem.*, 109: 489, 1935.
[3] Dakin, Ungley and West, *Jour. Biol. Chem.*, 115: 771, 1936.
[4] Sladek, Savczycka and Lipschuetz, III. Kongr. Slovenskih Aptekar. Jugoslaviji, Prague, page 266, 1935.
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[6] Lalund and Klemm, *Acta med. Scand.*, 88: 620, 1936.
[7] Karrer, Frei and Fritsche, *Helv. Chim. Acta*, 20: 622, 1937.
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SCIENCE NEWS

Science Service, Washington, D. C.

WORK OF THE NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMY OF SCIENCES

SCIENTISTS of the United States are making their knowledge and experience available for the war effort through committees of the National Research Council of the National Academy of Sciences. A great stock of information already in existence has been thus pooled, and has been placed on record in well over a hundred reports furnished to the War Production Board and its predecessor organizations. Directions which new research should take have also been indicated.

Especially important has been the work of the Metals and Minerals Advisory Committee, of which Clyde Williams, director of Battelle Memorial Institute, Columbus, Ohio, is chairman. This committee has already turned in well over a hundred reports. About half of them are on metals substitution and conservation, a little less than half on ferrous minerals and ferro-alloys, with several additional reports on tin smelting and reclamation and on non-metallic minerals.

A very considerable proportion of the reports are concerned with three "bottleneck" metals, aluminum, magnesium and manganese. The first two are basic materials for aircraft, the third is a key material in modern steelmaking. With all three, our present difficulties arise largely from the fact that before the war the respective industries naturally utilized only the highest-grade sources, which were most easily worked. Now, however, these "cream" sources are not sufficient to meet the enormously expanded demand, and scientists are called upon to tell what may be done about realizing values from some of the "skim-milk" ores.

Other investigations of the committee range through the whole alphabet of the minerals, from antimony and asbestos to zinc and zircon. In some cases, rarer and more costly metals may become replacements for those that are more abundant and cheaper in normal times; as in the substitution of lead-silver solder for the old familiar lead-tin solder, thus releasing tin for use where it is more urgently needed.

This set-up of a national clearing-house for scientific ideas and information in a nation at war continues a tradition that goes back to the administration of President Lincoln. In 1863 he chartered the National Academy of Sciences as a means of making the then existing scientific resources of the country available for the use of the Federal Government.

During the first World War the National Research Council was organized as a committee of the academy, to carry on the same kind of work in the vastly more highly developed fields of science that had come into being since Reconstruction days. The council continued in existence during the interim between the first and second World Wars, and now again attacks the task, with greatly expanded personnel and facilities.

THE COMMITTEE ON TECHNICAL DEVELOPMENT

THE Committee on Technical Development, a new body for the promotion and correlation of research in general industrial production, is now taking shape within the War Production Board, under the guidance of Maury Maverick, chief of the Bureau of Government Requirements. It is intended to operate along lines parallel to the work of the Office of Scientific Research and Development and the National Inventors Council, supplementing, though not duplicating, their efforts. An appropriation of \$100,000,000 is being asked for, to finance the work of the committee. Associated with Mr. Maverick in the new project are a number of research men and administrators, including Dr. Charles I. Gragg and Dr. C. C. Hill, Jr., both of Donald Nelson's organization.

As the research men picture their task, it involves several separate steps for each of the industrial problems with which the country is faced to-day. First is a survey of the problem itself, a determination of its magnitude and of all the factors involved that can be discovered. This is done largely by calling in groups of representative industrialists, engineers, and government and university research workers who know about various phases of the problem.

Having thus outlined a particular job, the next thing is to lay it out as a research project and find places where existing laboratory facilities will permit rapid work. This is very likely to involve a breaking down of the project into sections, and "farming out" the sections to universities and technical schools which have the necessary apparatus and personnel not yet employed on war research jobs. In this part of its work, the Committee on Technical Development would be functioning along lines analogous to those of the Smaller War Plants Corporation of W.P.B., in procuring the completion of jobs by sub-contract.

After the laboratory research stage comes the pilot plant, where processes until then done only by spoonfuls in test-tubes are expanded to middle-sized batches—say a couple of hundred pounds—in relatively small kettles or retorts, similar to those of factories, only not so big. Here is where the jobs graduate from "pure" chemistry into engineering chemistry, where "bugs" are discovered and eliminated.

Finally, after the pilot plant has carried the task so far as it can, it goes to the full-scale industrial plant for regular commercial development. The interval between pilot plant and factory is the "slip 'twixt cup and lip" where many a hopeful research project has died, and been embalmed in neatly bound research reports that only gather dust on library shelves, instead of rolling dollars in bank accounts and payrolls. One of the big jobs of the Committee on Technical Development will be to help practicable research results to become practical and real in the marketplace.

Even before formal organization and financing, the committee has made a number of beginnings. One hitherto neglected possibility of natural rubber has been turned up in the strangling-fig vines that grow wild in southern Florida and the West Indies. Little is known about it as yet; it is one of the research tasks that will have to be done from the ground up.

Agar, a vegetable jelly made from seaweed and indispensable in bacteriological and medical research, has always been imported from Japan. Small American manufactures of this substance have been of good quality but insignificant in quantity. New seaweed sources that may help ease us out of this bottleneck have been turned up on the Florida coast.

Silk is still needed for certain military purposes; nylon, rayon and other substitutes have not proved wholly satisfactory. We have abundance of mulberry trees, a seed-stock of silkworms—and thousands of Japanese women in internment camps who would be glad of a chance to undertake their traditional job of unreeling the cocoons to earn a little money.

These are only samples of the thousands of projects awaiting formal organization of the Committee on Technical Development. The work that can be expected of it should not only aid materially in winning the war but in stabilizing the peace.

ALUMINUM FROM CLAY

A REPORT officially released by the National Academy of Sciences states that aluminum from clay may get War Production Board approval. At least the Board is considering several processes involving not only clay, but alunite, low-grade bauxite and other domestic sources in the event that our supplies of high-grade bauxite from British and Dutch Guiana, which has accounted for 60 per cent. of our whole supply, may be greatly diminished or wholly cut off by the U-boat warfare in the Caribbean Sea.

These processes have been investigated for more than a year by the National Research Council of the Academy, and a report has been made at the request of the WPB by Dr. Zay Jeffries, chairman of the Metals Conservation and Substitution Group of the Advisory Committee on Metals and Minerals.

All the aluminum in this country has been made until now from high-grade bauxite (containing less than 7 per cent. of silica) by the Bayer process, which is the cheapest way, provided high-grade bauxite is available. But this process does not extract all the alumina (aluminum oxide) from even the best of ore, and the poorer the ore, the greater the waste and the greater the expense for chemicals.

The clay processes can be used in two ways, the committee found. Aluminum oxide (alumina) can be extracted directly from the clay, or silica can be partially removed from high-silica (low-grade) bauxite to convert it to low-silica bauxite which can then be treated by the Bayer method. In either case the metal is then extracted by electrolysis.

The tailings, thrown out by the Bayer plants, called red mud on account of its color, can be considered as clay, the committee pointed out, and the clay process applied. They recommended that clay-reducing plants be added to existing Bayer plants. High-silica bauxite can then be fed to the Bayer plant which will remove about 70 per cent. of the alumina and the clay process applied to the tailings will get most of the rest.

In particular the committee recommended that the clay process be applied to the millions of tons of red mud that has accumulated during the past thirty or more years at the East St. Louis plant of the Aluminum Company of America. This mud contains as much alumina as is contained in 1,000,000 tons of bauxite. It also contains large quantities of lime and soda, materials used in both the Bayer and the clay processes. The proportion of alumina to silica is higher than in kaolin clay which is almost pure aluminum silicate. It is good aluminum ore. It is already mined and pulverized, and contains a part of the materials needed for its own reduction.

There are two kinds of clay process, the acid and the alkaline. The committee favors the latter which consists in the main in mixing the clay with lime and soda, sintering and washing. The Tennessee Valley Authority has been experimenting for the past five years with an acid process applied to white kaolin clay, but the committee finds that the alumina it produces is not as yet sufficiently pure. However, the TVA is continuing its investigations and hopes to perfect the process.

Finally alunite or alum stone, a common mineral, is another source of aluminum. The reduction requires sulfuric acid, a substance for which there are enormous other demands in the war effort. But the stone is composed mostly of potassium-aluminum sulfate, so that the acid can be made from the sulfur present in the mineral.

Next to low-silicon bauxite the best ore for aluminum is high-silicon bauxite, and the best use of the clay process is in connection with a Bayer plant. Meanwhile search for new domestic sources of bauxite should be vigorously continued. There are no known deposits in Mexico or Canada.

JAUNDICE AND YELLOW FEVER VACCINATIONS

DANGER of jaundice breaking out in the Army among troops vaccinated against yellow fever is now over, in the opinion of the Surgeon General. Full information about the jaundice outbreak is now released for the first time, although this and other press services and newspapers of the nation have known about the outbreak for some time, but withheld the information at the request of Army authorities pending results of the scientific investigation which started when the first cases occurred.

Contrary to rumors circulating for some weeks, no case of yellow fever has occurred in any of the troops. The sickness was catarrhal jaundice, an ailment that occurs in civil life and for which no specific germ cause has been identified. Since March 1, there have been 28,585 cases of catarrhal jaundice in some of the men vaccinated against yellow fever. There were 62 deaths. This is a rate of one death to each 461 men who got sick, not one in 461 of all vaccinated. The numbers of deaths and of cases of jaundice were not large enough

to affect the war effort nor were they large enough to change the low death and sickness rates for the Army as a whole.

Jaundice occurred only in men vaccinated with certain batches of yellow fever vaccine. The vaccine was made from chick embryo pulp which had been suspended in normal human blood serum. This type of vaccine had been used for a million vaccinations before the jaundice cases developed among troops getting the vaccine.

The human blood serum was used because it keeps the vaccine active longer when it is stored before use. The unidentified germ of catarrhal jaundice may have got into certain batches of vaccine from this serum. The point is not yet definitely proved, but acting on the possibility, the Surgeon General has ordered all yellow-fever vaccine for the Army to be prepared with water instead of the human serum.

This change was made on April 15. Cases of jaundice have been definitely decreasing in numbers for the last three or four weeks. Peak of the outbreak apparently came during the week ending June 20, when 2,997 admissions were reported during the week. The peak in number of cases occurred after the vaccine had been changed because it takes some time for the disease to develop. The cases reported were among men who had been given the human serum vaccine before April 15.—JANE STAFFORD.

JAPANESE BEETLES

JAPANESE beetles are swarming over the great power dam at Conowingo, between Baltimore and Philadelphia. They're all over the roadway that crosses the huge concrete structure, thousands upon thousands of them.

Nobody knows why the beetles should be so numerous over the dam, except that they are pretty numerous all through their Middle Atlantic coast range this year. It is possible that mass flights of them, crossing the water or flying up air currents toward the dam, become tired and settle down to rest. All explanations that have been hazarded thus far are frankly guesses.

A real threat is the danger to the elms in over-widening radius around New York City from the fungus plague that has been misnamed Dutch elm disease. (It didn't come from the Netherlands but from Central Europe.) Due to war-time economics in appropriations, and in particular to the dissolution of the C.C.C. and drastic cuts in the number of W.P.A. workers, it is not possible for public agencies to do any work within the area known to be infested. All that is being done this summer is scouting along the edges of the infested region, to find any new spreads of the disease.

The beetles that disseminate the fungus are breeding, flying and getting into new trees now, and they will be most active during all of August. Since federal aid in the elm disease campaign is lacking, local communities and private individuals who value their elms will have to look out for themselves.

Grasshoppers and chinch bugs are reported active in parts of the Midwest and Plains regions. The long, cool spring held them in check somewhat, but with the coming of warmer, corn-ripening weather they are asserting themselves. There is enough arsenic-poisoned bait to last out this summer's anti-grasshopper campaign, but since arsenic is an essential war material, used in khaki dyes and for other industrial purposes, it is unlikely that there will be any for use next summer. The best bet is to reduce this year's infestation as thoroughly as possible, so as to cut down the number surviving to lay overwintering eggs in the fall.

ITEMS

MANUFACTURERS of war equipment have been asked by the War Production Board to start immediate programs for salvage of the "over-spray" of the paint spraying process, from which 100,000,000 pounds of essential chemicals can be recovered, according to estimates of the Chemical and Textile Units of the WPB Conservation Division, based on a nation-wide salvage survey of the paint situation. Army tanks, trucks, jeeps, and other military machines must be mass spray-painted with the familiar olive drab. Millions of shells must have a protective coat of nitrocellulose lacquer enamel. It is estimated that about 30 per cent. of the materials used can be recovered from the sludge of water-spray. Pigments, glycerine, oils, resins, gums, chlorinated rubber, cellulose and plasticizers are some of the materials that can be recovered by tried and tested methods, and the cost of the painting can also be reduced.

MILK-FED chickens may yield place, on premium market and restaurant listings, to soybean-fed chickens, at least for the duration. Soybean oilmeal is recommended as a substitute for dried milk in poultry rations, as increasing quantities of the latter food are sent overseas in Army supplies and lend-lease exports. The recommendation is made in a committee report of the National Research Council. In addition to replacing the milk proteins, soybean oilmeal is also a good source of riboflavin, one of the necessary vitamin materials ordinarily supplied in milk, the report states.

THAT hatchery raised trout can be distinguished from those that were hatched and grown entirely in the wild by examining their back fins, has been discovered by C. N. Feast, director of the Colorado Game and Fish Commission. Trout grown to legal size in a hatchery, he says, have dorsal fins somewhat degenerated through crowding. When they are released into the roomier waters of streams, the fins develop to full size, but are always malformed, and their cartilage structures are always cracked. This does not detract from the fish's health, gameness or flavor, but does form an identifying mark. Using this means of detecting hatchery-raised fish, Mr. Feast cruised the Gunnison, one of Colorado's best known streams, and found that 80 per cent. of the trout in it are hatchery-raised, a result of the commission's policy of raising its fish to full legal size instead of releasing them as fingerlings. Despite the war, there has been only a slight decline in number of fishing licenses. The decrease has probably been mainly among out-of-state fishermen, who find it more difficult to get to their favorite angling streams than in normal times.

SCIENCE

VOL. 96 FRIDAY, AUGUST 14, 1942 No. 2485

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

A CRITICAL EXAMINATION OF SOME CONCEPTS IN RUBBER CHEMISTRY[1]

By Dr. THOMAS MIDGLEY, JR.

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VULCANIZATION

IT is now over one hundred years since Goodyear discovered vulcanization. Broadly speaking, vulcanization is a process whereby a semi-useless vegetal product is converted into the most amazingly versatile raw material the world of industry has ever known. Need I recite your daily contacts with it? For example, when you take a shower bath, your faucet valve is faced with rubber, the curtain is rubberized cloth, the mat that keeps you from slipping is rubber, and the imitation sponge you use is vulcanized rubber in still another form. And when you play, golf balls, tennis balls, footballs and baseballs all depend on vulcanized rubber for liveliness. Notice that I didn't mention tires. They are almost too sacred to talk about these days. And yet after a century, rubber chemists are in less agreement on the nature of the chemistry of vulcanization than Goodyear's neighbors were that he was crazy. Nor has a Hall of Fame jury yet been selected with brains enough to honor Goodyear's memory as it deserves. It is all most astounding; but also is vulcanization.

If one wished to manufacture some rubber article,

[1] The concluding part of the address made by Dr. Midgley on the occasion of the presentation to him of the Willard Gibbs Medal of the Chicago Section of the American Chemical Society at Chicago on May 27. The presentation of the medal was made by Professor Harry N. Holmes, national president of the society.

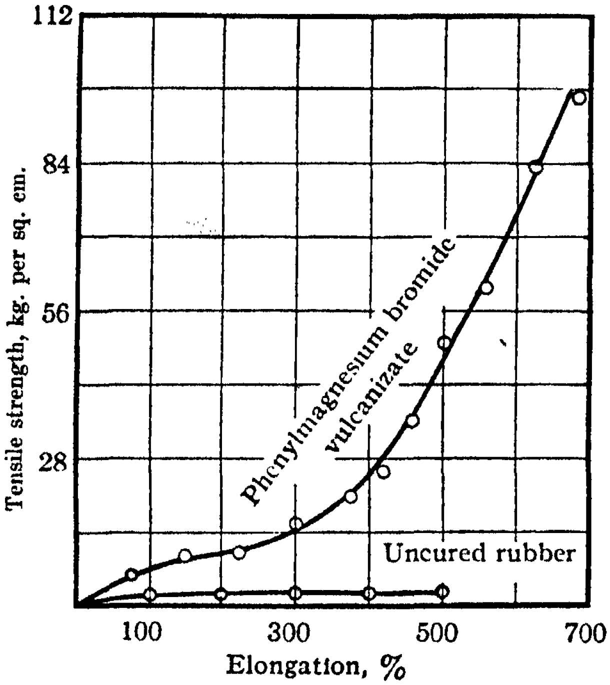
the first thing is to get a priority order; after that, the crude rubber may be obtained. The crude rubber is broken down on a mill to make it plastic, sulfur and other things are added, and the rubber is shaped to the desired form and held there for some time while being heated; after that the article is finished. Comparison of the crude rubber and the finished article will show that many physical properties are remarkably alike *qualitatively*, *although enhanced quantitatively* in the vulcanizate. Naturally, this suggests that vulcanization is reversed breakdown; therefore, if breakdown is the result of molecular ruptures, it logically follows that vulcanization must be molecular building up by polymerization or condensation. This indeed is an easy conception to visualize. It gives an explanation of the part played by sulfur—simply that the sulfur atom connects two rubber molecules by joining to each of them by primary valences. The simplicity of this broad concept has won many converts, too many, for it has one grave error. There is not one single piece of sound evidence that it is true and many that it is not. In the first place, vulcanization is not breakdown in reverse, except in a very superficial way. Incipient and then progressive vulcanizates do not show the regular steps of increasing viscosity and decreasing solubility that would be expected; nor can a vulcanizate be obtained that gives quantitative properties corresponding to those of unbroken-down rubber. At first there is a slight rise in viscosity during vulcanization and a slight decrease in solubility, then a sudden conversion to a gel type rubber. During the early stages of this gel formation the gel can be peptized by various agents.[2] Who ever heard of peptizing primary valences?

Consider both breakdown and vulcanization from a different point of view. Instead of assuming that unbroken-down rubber is elastic with fair tensile strength because its molecules are long and that broken-down rubber is plastic because its molecules are short, imagine that the difference in plastic properties of unbroken and broken-down rubber is caused by a difference in the ease with which the molecules slip past one another under stress. True, this difference may be the result of different lengths of molecules or it may be that in broken-down rubber a few small molecules act as lubricants for the larger ones just as a small amount of lubricating oil in unbroken-down rubber will give a plasticizing effect. This concept does not require the rebuilding of large molecules out of small ones to account for the change that is called "vulcanization." Any procedure which results in reduced slipping will accomplish a change of this sort; witness the loading effect of carbon black or zinc oxide. But the reduction of slipping is not all there is to vulcanization. Were it all, then vulcanized rubber would disperse instead of merely swell in suitable solvents. Therefore we must assume the creation of intermolecular attractions of some sort during vulcanization. This, of course, can be accomplished by sulfur bridges between molecules. If this were the only possibility, the slipping concept would merely have been a mental detour which returned to the original starting point. But sulfur bridges are by no means the only way to stop slipping. We also have the possibility of creating groups on the molecule which will cause association. Call these polar groups or secondary valences or what you will, but in any case they differ distinctly from primary valences. The question now resolves itself into differentiating between these two concepts—namely, attraction by primary valences and attraction by association forces. The following observations are pertinent. If vulcanization is stopped at a point just beyond gel formation—that is, where the vulcanizate will swell but no longer disperse in rubber solvents—then this vulcanizate can be dispersed by peptization.[3] It is difficult to see how this could be so if this gel were held together by primary valences; on the other hand, a gel held together by association forces would be expected to behave in such a manner. Again, as the amount of combined sulfur increases, a maximum point of vulcanization properties is reached after which most of these properties decrease until, at about half saturation, the vulcanizate has decreased in physical properties corresponding almost to the condition of broken-down rubber. It is difficult to see how this can be explained on the basis of primary valence formation; whereas if the forces of association are considered to be due to the formation of some kind of polar groups, the phenomenon becomes easily explainable on the basis that, as long as the polar groups of a given molecule are far enough apart, strong external forces, capable of attracting other molecules, will be in existence. But when the number of such groups are increased and they are crowded closer together, their respective forces will be satisfied by internal attraction leaving only a small portion for attracting other molecules. This explanation admittedly is hypothetical, but it serves to demonstrate that a rational explanation of the phenomenon of overvulcanization can be based on the concept of association forces, whereas no similar explanation is forthcoming based on the primary valency concept. Even the simple observation that the slight swelling by solvents of well-vulcanized rubber greatly reduces its tensile strength also favors the association concept. For if the mass were held together by primary valences, there would seem to be no more reason for

[2] Williams, *Ind. Eng. Chem.*, 26: 1190, 1934.

[3] *Ibid.*

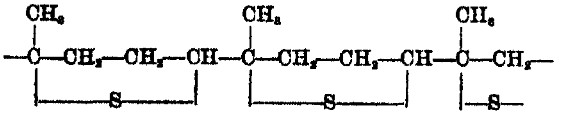
a loss of strength than occurs in a sponge when it is filled with water, while if it were held together by association forces, the adsorption of solvent would increase the distance between molecules and thus reduce the strength of the forces holding them together.



STRESS-STRAIN CURVE

FIG. 1

Several years ago we attempted to establish the existence of primary valence linkages between molecules by destructively distilling well-vulcanized rubber and examining the products in the hope of finding one which could be related to such a linkage. The resulting products differed in no significant detail from those obtained from the destructive distillation of crude rubber. We next extended this work to the destructive distillation of ebonite $(C_5H_8S)_n$, without obtaining any compound suggestive of intermolecular linkage.[4] We did obtain a group of substituted thiophenes, representing only a small part of the whole, which we interpreted[5] as demonstrating a linkage of sulfur to the rubber molecule:



While such negative evidence can not be considered as disproving the possible existence of primary valence linkages between molecules, it does add to the total weight of evidence against their existence.

In contradistinction to the negative results obtained in our search for evidence to substantiate the primary valency concept, we were able to obtain positive evidence that association forces could be used exclusively for vulcanization. We discovered that the addition of Grignard reagents to rubber solutions would cause gelling. We extended this discovery to the vulcanization of a test sample of broken-down rubber.[6] The resulting stress-strain curve is shown in Fig. 1. This is a typical curve for a vulcanizate. The tensile strength is too great for a mere loading effect, and it is difficult to see how a small amount of methyl magnesium bromide could act as a loading agent anyway; nor is the tensile strength so very bad when it is considered that no loading agent was present. There can be no question that this result is true vulcanization. Grignard reagents do not produce intermolecular linkages; also the vulcanizate could be reverted to its original broken-down condition by counteracting the Grignard with alcohol. The recovered product could be revulcanized with Grignard and recovered again as many times as desired, a further demonstration that intermolecular primary valences were not generated in the vulcanization.

In view of the preponderance of evidence in favor of the association concept of vulcanization and the complete lack of any basis for the primary valence concepts, it is surprising that rubber chemists continue to think in terms of primary valence as an explanation of the vulcanization reaction.

RETRACTION

The retraction of rubber—that is, the property which causes rubber to return to its original shape and size with force after being stretched—is the outstanding characteristic that distinguishes it from chewing gum, beeswax and tar, and makes it into the useful material it is. The study of this property really falls in the field of physics rather than chemistry, but its importance justifies its inclusion in any discussion of rubber or rubber chemistry. Indeed, this property is so important that any material which possesses it can be called a rubber, no matter what its chemical constitution.[7]

The early students of this property took the viewpoint that rubber was analogous to gelatin in some way, that it was some sort of two-phase system,[8] that it was a colloidal suspension,[9] that it was corpuscular in structure,[10] that its molecules were gathered together in miscelles,[11] etc. None of these conceptions

[4] Midgley, Henne and Shepard, *Jour. Am. Chem. Soc.*, 54: 2953, 1932.

[5] *Ibid.*, 56: 1326, 1934.

[6] *Ibid.*, 56: 1156, 1934.

[7] Midgley, in Davis and Blake's "Chemistry and Technology of Rubber," A. C. S. Monograph 74, p. 679, 1937.

[8] Freundlich and Hauser, *Kolloid-Z.*, Spec. No. 36, 15, 1925.

[9] Pummerer, Nielson and Gündel, *Ber.*, 61: 1583, 1928.

[10] Freundlich and Hauser, *loc. cit.*

ever yielded constructive results or advanced rubber technology.

Some twenty-odd years ago, after Staudinger announced the long-chain structural formula, opinion began taking shape that the extension and retraction of rubber were simply an integration of the behavior of the component molecules.[12] In other words, it was assumed that the rubber molecule itself is subject to extension and exhibits forceful retraction thereafter. This concept has steadily gained ground. It is true that no direct evidence exists to confirm this concept, and by its very nature perhaps there never will be; on the other hand, no contradictory evidence exists, which very well could if this concept were in great error. Therefore, until some such evidence is obtained or a concept is developed which fits the facts more accurately, this theory should be accepted as the nearest available approach to the truth.

Under this concept a generalized theory of molecular behavior has been developed. For example, refer to Staudinger's long-chain formula above. It is obvious that this is not a true space configuration since the tetrahedral characteristics of carbon atoms are disregarded. Imagine such a space model and take into account that parts of this molecule can rotate about any single bond. Now fold the molecule back on itself many times about single bonds and a much more compact model is obtained than would appear from looking at the long-chain formula. This is a good picture of how a rubber molecule may retract, but it gives no insight into why it does so. Long paraffin molecules, such as hydrogenated rubber, could do the same thing as far as structure goes, but they do not. Rubber molecules do. Why?

Two explanations have been offered; one is by Shecklock[13] with later variations by others, based on thermal and thermodynamic considerations, and one is by Mack,[14] who makes use of van der Waals forces, applied to scale models. I am incompetent to differentiate critically between these two. Each of them fits certain observed data better than the other, but Mack's concept appeals more strongly to me, as it is based more closely in the fields of rubber chemistry with which I am familiar, and it predicts quite well the behavior of rubberlike and related substances of known composition, structure and isomerism. Its extension might be useful in predicting new molecular forms which could lead to better and less expensive synthetic rubbers than we now have.

As just stated before, I am not qualified to criticize either of the above theories, but I do feel qualified to criticize both rubber chemistry and chemists for not having mastered either of them more thoroughly. That they are difficult to master is no excuse, for the rubber chemist who expects to serve humanity well must be prepared to master many things more difficult than either of these theories.

In closing I should like to make myself clear on one point. I have not hesitated to criticize, severely, those concepts which are in disagreement with the results that I and my colleagues have obtained. I have done this in the full knowledge that I can be just as wrong as any one else, and I shall feel grateful to any one who proves that I have been, for then I shall profit by such proof in increasing my own understanding of these problems. Likewise I shall feel pleased if our results are confirmed, for then I shall have the satisfaction of feeling that I have aided in advancing rubber chemistry. I can be disappointed in only one way, to have our results ignored.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE TWENTY-SIXTH ANNUAL MEETING OF THE PACIFIC DIVISION. II

Edited by Professor J. MURRAY LUCK

SECRETARY

AMERICAN SOCIETY OF PLANT PHYSIOLOGISTS, WESTERN SECTION

(*Report by D. I. Arnon*)

The annual meeting of the Western Section of the American Society of Plant Physiologists was held at Salt Lake City, Utah, from June 17 to June 19.

The effect of war conditions was reflected in a number of last-minute cancellations of papers by prospective participants, but the cooperation of societies in arranging joint sessions for topics and papers of mutual interest contributed to the success of the meeting by favorably influencing both program and attendance. The program consisted of a symposium on "Organic Matter in Relation to Plant Growth," sponsored jointly with the Western Society of Soil Science and the Western Section of the American Society for Horticultural Science; a symposium on "Present Concepts of Water Relations of Plants,"

[11] Meyer and Mark, *Ber.*, 61: 1939, 1928.

[12] Astbury, *Ann. Repts. Chem. Soc.*, 1931, 322.

[13] Shecklock, *Trans. Inst. Rubber Ind.*, 8: 568, 580, 1933; 9: 94, 1933.

[14] Mack, *Jour. Am. Chem. Soc.*, 56: 2757, 1934.

sponsored jointly with the Pacific Division of the Botanical Society of America and the Horticulturists; and three sessions of submitted papers, one session with the Botanists and another with the Horticulturists.

The symposium on organic matter in which papers were presented by J. Bonner, L. T. Kardos and jointly by J. E. Greaves, K. R. Stevens and L. W. Jones assessed some of the present concepts on the direct and indirect role of specific organic substances on the growth of intact plants under natural conditions in soil.

The symposium on water relations, which attracted the interest of many, covered in a series of well-prepared papers the following aspects: the forces governing absorption and movement of water in plants, by A. S. Crafts; the structure and function of water-conducting tissues, by H. E. Hayward; the relation of soil moisture at various levels to plant growth, by L. A. Richards; and problems of water deficiency with special reference to grasses, by D. F. McAlister.

The Thursday morning session for submitted papers included the presentation of data obtained under highly controlled conditions on root respiration and certain phases of sulfur metabolism in plants by M. D. Thomas, R. H. Hendricks and G. R. Hill. A negative correlation between CO_2 evolution by roots of Vinifera and Labrusca grapes and the respective susceptibility to chlorosis was reported by F. B. Wann. H. E. Hayward, W. M. Blair and P. E. Skaling found by means of a special device that the most active zone of water absorption in corn and citrus roots is that of the region of differentiation. H. T. Northen discussed the relation of cellular activities to protein behavior with special reference to reactions involving protein dissociation, and J. Bonner presented observations on the distribution and transport of riboflavin and pantothenic acid in plants.

Other papers included an interesting study of chlorofucine and fucoxanthine, green and yellow pigments of diatoms and brown algae, by H. H. Strain and W. M. Manning. The continuous application that radioactive isotopes find in physiological research was reflected in a paper by O. Biddulph on the movement of radiophosphorus and in another by T. C. Broyer and D. R. Hoagland on the relation between permeability and accumulation. Three papers dealt with micronutrient deficiencies: H. S. Reed discussed the effect of nutrition on vacuolar components, E. Archibald and F. B. Wann reported on the zinc content of deficient and normal leaves, and D. I. Arnon reviewed the present status of the indispensability of molybdenum for higher plants. C. H. Davis presented evidence on the direct relation between reduced moisture content and the decreasing rate of growth, and W. O. Williams reported on the effects of temperature on the composition of tracheal sap in some woody plants.

A most interesting trip through the greenhouses and laboratories of the American Smelting and Refining Company, conducted by Drs. G. R. Hill and M. D. Thomas, was enjoyed by the group on Friday afternoon.

The officers for the coming year, as announced at the annual dinner are: *Chairman,* E. T. Bartholomew; *Vice-Chairman,* F. J. Veihmeyer; *Secretary,* D. I. Arnon.

Association of Pacific Coast Geographers

(*Report by Willis H. Miller*)

The first day of the association meeting was devoted to the geography of Utah, with special emphasis on the unique farm villages which characterize the Mormon commonwealth. In a paper on "Utah House Types" Dr. J. E. Spencer, of the University of California at Los Angeles, traced the history of Utah houses from the earliest ill-adapted "Hollywood" stucco bungalow. Dr. J. A. Geddes, of the Utah State Agricultural College, called attention to the large areal extent and the widely scattered houses typical of many Mormon farm villages. To this feature he largely attributed the low proportion of homes having piped water, gas, electricity and sewage connections. As a solution, Dr. Geddes recommended the development of long, narrow farmsteads, each having relatively short frontage on the main village street.

During the afternoon a spirited symposium on "Utah Mormon Village Communities" was held under the leadership of Dr. George H. Hansen, of Brigham Young University. A qualified panel of experts thumped and probed the physical, economic and social bodies of Utah villages. It was agreed that, although these villages have relatively declined, a combination of community pride and good planning could again make them attractive, efficient places in which to live and make a living.

At the morning session on the second day, D. W. Thorne, of the Utah State Agricultural College, and D. A. Anderson, of Brigham Young University, discussed "Irrigation and Permanent Agriculture." An analysis of ancient irrigation projects and studies of Western irrigated lands led them to conclude that irrigated agriculture was as permanent as any other type. Dr. L. O. Quam, of the University of Colorado, illustrated his timely paper on "The Use of Maps in Propaganda" with a collection of recent German maps.

Papers presented during the afternoon included an illustrated talk on "Erosion Lessons to be Learned

from Mexico," by W. A. Rockie, of the Soil Conservation Service. Mr. Rockie stated that erosion is so wide-spread that he believes Mexico will be hard pressed to produce enough food to support its population within fifty years. In his paper, "Geopolitics—Some Implications and Applications," Dr. Willis H. Miller, of the California State Planning Board, stressed the value of geopolitics as a device for determining policy, recommended the establishment of a Federal Geopolitical Office, and outlined several examples of geopolitics as applied to current and future problems of the United States.

BOTANICAL SOCIETY OF AMERICA, PACIFIC SECTION

(Reported by Bassett Maguire)

The program of the Botanical Society consisted of one symposium and four half-day sessions for the presentation of submitted papers.

In the Wednesday morning session three interesting papers dealt with some physiological and genetical problems of the sugar beet; two further papers treated the distribution of members of the Saprolegniaceae in Southern California and Desmid records for Utah.

On Wednesday afternoon a most interesting joint symposium was held with the Physiological Society of America and the American Society for Horticultural Science on the "Present Concepts of Water Relations of Plants." A. S. Crafts, H. E. Heyward, L. A. Richards and D. F. McAlister presented papers.

The Thursday morning session, held jointly with the Ecological Society of America, consisted of a presentation of papers, primarily ecological in nature. A series of papers treating various problems of range ecology and management elicited much interested comment. Others dealt with soil drought resistance in grasses, and production and maintenance of zooplankton in coastal waters of southern California.

A joint session for the presentation of papers of primarily taxonomic nature was held on Friday morning. The paper given by C. L. Hitchcock, dealing with the origin of the Western species of *Draba*, excited considerable interest, as did likewise two following papers presenting a taxonomic-ecological relationship of the genus *Zigadenus*, and a discussion of the Post-pleistocene vegetation and climate of the Pacific Northwest.

At the annual business meeting held on Wednesday morning the following officers were elected: *President*, Henry P. Hansen; *Council Member*, W. R. Hatch.

CALIFORNIA ACADEMY OF SCIENCES

(Report by R. C. Miller)

The program of the California Academy of Sciences took the form of a progress report of the Committee on Natural Illumination authorized at the Pasadena meeting a year ago. At a session on Thursday morning, R. C. Miller gave a general report on the organization and work of the committee, and presented some results of continuous recordings of daylight in San Francisco over a period of nine months. C. L. Utterback reported on the visibility of near and more distant objects, and of different colors, in morning and evening twilight of carefully measured intensities. The session concluded with a round table discussion of the applications of illumination studies in various fields, with emphasis on the possibilities of their use in meteorological forecasting.

ECOLOGICAL SOCIETY OF AMERICA, WESTERN SECTION

(Report by A. M. Woodbury)

The Ecological Society of America, Western Section, held its meetings on June 17 and 18. The excursions scheduled for June 19 and 20 had to be cancelled because of transportation problems related to war activity. On Wednesday morning, June 17, a symposium dealing with "Salinity as an Ecological Factor" was held jointly with the Western Society of Naturalists. Four papers were presented: W. D. Billings dealt with plants in the Lahontan Basin; Seville Flowers, with plants in the Bonneville Basin; Angus M. Woodbury, with animals in the Great Basin; and Walter P. Cottam, with plant types after a century of human occupancy.

The Biologists' dinner on Wednesday evening was attended by many ecologists. On Thursday morning, a joint session with the Botanical Society of America, Pacific Division, was held, at which seven papers were presented by S. S. Hutchings, George Stewart, L. A. Stoddart and A. D. Smith, A. W. Sampson, D. F. McAllister, O. S. Walsh and M. W. Johnson.

THE OCEANOGRAPHIC SOCIETY OF THE PACIFIC

(Report by C. L. Utterback)

The program of the society consisted of a symposium on the "Resources of the Sea for Wartime Economy," and of an afternoon session of contributed papers.

"The Latent Marine Fisheries Resources of the Pacific," from Alaska to the coast of Mexico, were discussed by Dr. R. S. Croker, of the California State Fisheries Laboratory, and Dr. W. M. Chapman, of the Washington Shellfish Laboratories. An interesting analysis of the abundance and possible utilization was made of the many resources which are not now used commercially. This analysis included the results of the investigations of the various fish commissions, as well as a discussion of the problems pertaining to the canning and marketing of many of the less familiar food fish. The discussion of the Marine Plant Resources was similar in nature to that of the

Marine Fisheries Resources. Problems relating to the abundance of various marine plants and the immediate utilization of considerable amounts of their products were included. This discussion was led by Drs. G. B. Rigg and Trevor Kincaid, of the University of Washington, and Dr. J. F. Wohnus, of the Scripps Institution of Oceanography.

An interesting paper presented by R. P. Dempster and R. C. Miller included the effect of the character and abundance of plankton on the penetration of solar light into sea water.

THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE

(Report by Charles C. Johnson)

The meeting of the Society for Experimental Biology and Medicine was held on Friday, June 19, at 1:30 P.M. Ten papers were read by the authors and four were read by title, as the authors were unable to be present.

J. Wolk and W. W. Smith, of the Department of Bacteriology of the University of Southern California, reported that 95 to 98 per cent. of samples of sugar obtained on the retail market would pass National Canners' tests and hence were suitable for home canning purposes.

Morphine used as a sedative in labor may either depress or stimulate uterine motility or have no effect whatever, apparently depending largely on the type and degree of uterine motility existing at the time of the administration of morphine. Dr. Con Fenning, of the department of pharmacology and physiology of the University of Utah, drew these conclusions after studies of uterine motility on 200 patients, using a recently perfected apparatus for recording uterine movement in pregnant women.

Dr. H. M. Schamp and Dr. H. M. Leicester, of the College of Physicians and Surgeons, Dental School of San Francisco, presented a new method for clearing teeth and bone by immersion in liquefied phenol for twenty-four hours. They then used this method to study caries in the teeth of rats to establish a caries index.

Using mercury-indigo-disulfonate, Dr. J. E. Davis was able to bring about either complete disappearance or regression of breast cancer in mice.

Clarence R. Mott, of the department of pharmacology and physiology of the University of Utah, reported a direct correlation between the increased growth and the basal metabolism in ovariectomized rats when proper selection of animals was made with relation to age and time elapsing between ovariectomy and determination of basal metabolism. He found that there was a statistically significant increase in basal metabolism in the ovariectomized rats when the operation was performed at 26 days of age and the basal metabolic rates compared with controls at the ages of 40 to 90 days.

WESTERN SOCIETY OF SOIL SCIENCE

(Report by W. P. Martin)

The meetings of the Western Society of Soil Science were featured by extensive field trips, cordiality of association and a representation from all the eleven western states. Attendance ranged from 40 to 80 soil scientists who listened to and discussed 26 papers on current research during four half-day sessions. In addition, three papers were presented during a symposium on "Organic Matter in Relation to Plant Growth," under the chairmanship of W. P. Kelley, in which the soil scientists collaborated with the plant physiologists and the horticulturists.

Papers ranged from a description of some of the results obtained on the excellent sand culture installation of the American Smelting and Refining Company by M. D. Thomas and R. H. Hendricks to the effect of denitrifying bacteria on soil structure by V. P. Sokoloff. The papers presented on Monday morning dealt chiefly with the influence of environmental factors on plant growth. Acidulated materials, phosphatic fertilizers, sulfur and alkaline salts were included in these discussions.

On Monday afternoon, the scientists examined soil profiles peculiar to the Salt Lake Valley under direction of D. S. Jennings. In the evening, a picnic supper was provided for 65 by the Utah State Agricultural Experiment Station in Logan Canyon; Professor D. R. Hoagland and O. C. Magistad contributed remarks on the place of the soil scientist in the war effort.

On Tuesday morning, papers ranged from a mathematical description of the precipitation data for Utah as related to erosion due to the influence of carbon dioxide pressure on the measurement of pH values. The effect of surface mulches on water intake, the influence of moisture tension on moisture retention, water-application efficiencies in irrigation and methods used for the reclamation of an alkali soil in Wyoming were discussed during this session.

On Tuesday afternoon the group were shown over the Davis County Water Shed Conservation Project of the Intermountain Range and Forest Experiment Station by George Stewart. How destructive floods had been effectively controlled by water-shed conservation practices was strikingly demonstrated on this trip.

On Wednesday afternoon, the eight papers presented dealt largely with the influence of environmental factors on soil properties. The influences of

irrigation, long-continued tillage of orchard soils, organic materials and soil microorganisms were considered. In addition, enzymatic *vs.* microbial concepts of urea hydrolysis, the maintenance of nitrogen in dry farm soils and the persistence of algae in old adobes were topics presented.

At the banquet on Wednesday evening at which were present fifty-one members and guests, President F. S. Harris, of Brigham Young University, described some interesting and peculiar agricultural problems of Iran.

Officers of the society elected for the coming year were as follows: *President,* T. L. Martin, Brigham Young University; *Vice-President,* O. C. Magistad, U. S. Regional Salinity Laboratory; *Secretary-Treasurer,* W. P. Martin, University of Arizona.

OBITUARY

RAYMOND L. DITMARS

As a keen student of human nature has reminded us, "Contemporaries appreciate the man rather than the merit, but posterity will regard the merit rather than the man." Most creative thinkers are content to have it this way, for they realize that they labor for future generations rather than for their own. The life and works of Dr. Ditmars will illustrate the truth of the observation. Quietly and persistently he toiled in his chosen field. To many biologists he was but little known; to others he was the modest curator of reptiles in the New York Zoological Park. But it may be safely predicted that future historians of American zoology will recognize in him an important contributor to the science.

Scientists too generally fail to appreciate that research is promoted not only by the efforts of skilled investigators but also by the labors of those who undertake to develop the students of the future. Zoologists particularly are prone to decry attempts to popularize the results of their studies. This is unfortunate, for most teachers will testify to the great value of natural histories and manuals in stimulating in the youthful mind an interest in the natural sciences. It is to this field that Dr. Ditmars has contributed effectively and permanently. He has successfully popularized, in the best sense of the term, the study of reptiles, and the results are already appearing in an augmented group of specialists in the habits, distribution and relationships of an important, difficult, neglected and much maligned group of animals.

Thus, while it will be the future Copes, Boulengers and Stejnegers who will really give to this man full credit, we who are privileged to have known him may feel proud to have been associated with one who is destined to be considered a good teacher. He would desire no other epitaph.

Dr. Ditmars died on May 12. The events of his life are given in biographical directories. "American Men of Science" prints the following:

Ditmars, R(aymond) L(ee), Zoological Park, New York, N. Y. *Natural history.* Newark, N. J., June 20, 76. Pub. and private schs. Asst. curator entom, Am. Museum Nat. Hist, 91–97; stenographer, 97–99; reporter, 'N. Y. Times,' 99–00; *curator reptiles, N. Y. Zool. Park, 00–, mammals, 27–* Soc. Ichthyol. and Herp; N. Y. Zool. Soc; N. Y. Entom. Soc; Linnaean Soc. N. Y. Herpetology; mammalogy; educational motion pictures.

ALEXANDER G. RUTHVEN

UNIVERSITY OF MICHIGAN

HENRY FRANCIS NACHTRIEB

HENRY FRANCIS NACHTRIEB, professor emeritus of animal biology at the University of Minnesota, died at his home in Berkeley, California, on July 17 in his eighty-sixth year. He is survived by his wife and daughter. Born near Galion, Ohio, in 1857, Professor Nachtrieb began his higher education at German Wallace College at Berea, Ohio. From there he came to the University of Minnesota and received his B.S. degree in 1882. Graduate work at the Johns Hopkins University from 1883 to 1885 completed his professional training. Returning to the University of Minnesota in 1885 as an assistant, he became assistant professor the following year and department head in 1887, which position he held until his retirement in 1925.

During his long service to the university he was untiring in his efforts to build up the work in zoology. When Governor John S. Pillsbury was considering the gift of a building to the university in 1889, Professor Nachtrieb was influential in having the building devoted to the natural sciences. As the work grew, and additional space became imperative, he was again influential in securing a legislative appropriation for a new building to be devoted exclusively to zoology. This fine modern laboratory was built in 1915, according to plans largely developed by him.

During the years of the Geological and Natural History Survey of Minnesota, Professor Nachtrieb was active in directing this work as state zoologist. At this time he began his work on the spoon bill or paddle fish, Polyodon. He accumulated much material on this extraordinary form, but, unfortunately, the greater part was never published. His published papers dealt chiefly with leeches and fishes.

In addition to his scientific interest, Professor Nachtrieb had a warm interest in the whole of human life

which manifested itself in many ways. He was active in church work. He was instrumental in establishing the Minnesota Chapter of the Psi Upsilon fraternity. He was one of the most active members of the General Alumni Association of the University of Minnesota, which was organized at a meeting called by him in 1904 and whose president he became for the following eleven years. He was a leader in many other movements, the purpose of which was to improve the university.

Thus a long and beautiful life of service has come to its close. Professor Nachtrieb will be long and gratefully remembered by the university to which he devotedly gave his life work. And he will be affectionately remembered by those of us fortunate enough to have known him as a beloved teacher, a wise counselor and a loyal friend.

D. E. MINNICH

UNIVERSITY OF MINNESOTA

RECENT DEATHS

DR. WADE H. BROWN, pathologist, member of the Rockefeller Institute for Medical Research at Princeton, N. J., died on August 4 at the age of sixty-three years.

DR. WILLIAM JESSE GOAD LAND, professor of botany at the University of Chicago until his retirement with the title emeritus in 1931, died on August 1 in his seventy-seventh year.

DR. CLARENCE ERROL FERREE, formerly professor of physiological optics and director of the research laboratory of physiological optics at the Johns Hopkins University, died on July 26 at the age of sixty-five years.

DR. JAMES HAYDEN TUFTS, professor of philosophy at the University of Chicago, who retired in 1930 with the title of emeritus, died on August 5. He was eighty years old.

DR. EDWIN W. MILLER, associate professor of mathematics at the University of Michigan, died on July 23, at the age of thirty-seven years.

DR. C. C. BUNCH, research professor in education of the deaf in the School of Speech at Northwestern University, an authority on otology and audition, died on June 14 at the age of fifty-seven years.

SIR FRANCIS EDWARD YOUNGHUSBAND, explorer of Tibet and northern India, died on July 31 at the age of seventy-nine years.

AN Associated Press dispatch reports the death at the hands of the Germans of eight Polish scholars and artists. Among them were Aleksander Patowski, formerly chairman of the Polish Geographic Society and counselor of the former Polish Ministry of Education in Warsaw, and Antoni Nisezorkiewicz, custodian of the National Museum of Warsaw.

SCIENTIFIC EVENTS

THE OXFORD INSTITUTE OF RESEARCH IN AGRICULTURAL ENGINEERING

THE *Times*, London, points out that the Agricultural Machinery Development Board for Great Britain, which was set up at the beginning of this year to arrange for the testing of agricultural machinery and implements and to consider questions of uniformity and standardization, the provision of educational and advisory facilities, and any matters relating to the mechanization of agriculture, requires a highly qualified staff of agriculturists and engineers with adequate workshop facilities. A National Institute of Agricultural Engineering is accordingly being set up at Askham Bryan, near York.

The nucleus of the institute is the Institute of Research in Agricultural Engineering at Oxford, which the University of Oxford has handed over to the Ministry. S. J. Wright, the director of the Oxford institute, has been appointed director of the new institute. The staff will be considerably strengthened and adequate workshop facilities provided. The institute will be housed temporarily during the war in buildings belonging to the Yorkshire Council for Agricultural Education, but when these have to revert, after the war, to their original purpose, it is intended to build a permanent home for the institute on a site near the temporary accommodation.

The main functions of the new institute will be to act as a general clearing house for information about agricultural machinery and its use, to carry out tests or demonstrations of new or improved implements, to undertake experimental and demonstration work on the better utilization of existing equipment, and to fill the gap between inventor and manufacturer by putting new ideas into practical shape and constructing the prototype machine.

THE HEBREW UNIVERSITY OF JERUSALEM

DR. J. L. MAGNES, president of the Hebrew University, has been appointed chairman of the Scientific Advisory Committee established by the War Supply Board for the purpose of investigating scientific problems in connection with the war effort. Professor L. Farkas, of the department of physical chemistry, is secretary of the committee. The scientific departments of the university are giving increased aid to industrialists, farmers, physicians and others in the performance of essential wartime functions.

American Friends of the Hebrew University report the scientific work being carried forward at the university as follows:

Industrial Research. Imports of materials required in industry having been reduced to minimal proportions, the manufacturers of Palestine are seeking to substitute such materials with local products. Many manufacturers have turned to the university for advice. A large number of factories are now using processes worked out for them in university laboratories.

Hormones and Vitamins. A recent instance of assistance to manufacturers is that of preparations of hormones and vitamins, previously imported, which have been developed from local substances in the laboratory of physiology. Several of these preparations are now being produced in commercial quantities. In this way a shortage of important drugs has been relieved and a stimulus given to the young pharmaceutical industry of Palestine.

Insulating Material. Inventors of a new insulating material made of papyrus from the Huleh swamps in Upper Galilee are receiving help from the department of physics in working out the technical manufacturing processes.

Chemical Research. Possibilities of developing basic chemical industries in Palestine are being closely studied in the university laboratories, and small model plants have been erected where graduate students of the university participate in the research work. One of these plants is being used by the department of inorganic and analytical chemistry in the production of sulfuric acid, an essential element of production which was imported before the war.

Scientific Apparatus. Still another way in which Palestinian industry is served by the university is in the construction of precision scientific apparatus and instruments which were imported before the war and which are now being made nowhere in the Middle East except in the laboratories and workshops of the university. The university participated in the Palestine Industrial Exhibition in Cairo last summer so that the manufacturers of other Middle Eastern countries might become aware of its industrial services. In a broadcast from Jerusalem on December 8 D. de Betherl, officer in charge of the Cairo Exhibit, lauded the ''astonishing scientific and technical resources of Palestine, and particularly of the Hebrew University and its research institutes.''

Nutrition. The department of hygiene and bacteriology has assumed as one of its chief tasks the creation of minimal wartime diets. The department also gives close scrutiny to foodstuffs offered for sale in wartime and to advising the Palestine population in regard to diets suited to local conditions of climate. Professor I. J. Kligler, head of the department, is chairman of the Nutrition Committee of the Jewish Agency's Economic Research Institute.

Courses for Physicians. Intensive courses for Palestinian physicians and for physicians of the military troops stationed in Palestine are being given under the joint auspices of the Hebrew University Medical School and the Rothschild Hadassah University Hospital. Professor Saul Adler, head of the department of parasitology, has lectured on the diagnosis of malaria; Dr. Dov Ashbel, head of the meteorological laboratory, on the influence of climate on health; Dr. E. Wertheimer, professor of pathological physiology, on recent developments in biochemistry; Professor Dybowski, of the department of parasitology, and Dr. G. Witenberg, lecturer in helminthology, on tropical diseases; Dr. I. Leibowitz, acting head of the department of chemistry in the Cancer Research Institute, on nutrition. Clinical lectures were given by Professor A. Feigenbaum on diseases of the eye; by Dr. J. Kleeberg and Dr. M. Rachmilewitz on endemic diseases, and Dr. B. Gruenfelder on children's diseases.

New School of Pharmacology. The Hadassah University Pharmacological Institute, opened in May, is meeting war needs and is supplementing shrinking drug supplies threatening to create health hazards in Palestine. The institute has launched a program of clinical research laboratory work in the extraction of vitamins, hormones and allied substances. Established by Hadassah, the new institute is staffed by investigators associated with the Hebrew University and the Rothschild Hadassah University Hospital.

Agriculture. At the beginning of the winter term, eighteen students of agriculture, who had taken the required courses in natural science for two years, were placed in several settlements for a year's practical training on the land. The year of practical work will be followed by two years' study of agricultural science in Rehovoth.

THE HANDBOOK OF SCIENTIFIC AND TECHNICAL SOCIETIES AND INSTITUTIONS OF THE UNITED STATES AND CANADA

THE National Research Council has recently issued the fourth edition of a "Handbook of Scientific and Technical Societies and Institutions of the United States and Canada" (National Research Council *Bulletin* No. 106, January, 1942; 389 pages). The United States section contains information on 1,269 societies, associations and similar organizations in the natural sciences and related fields that contribute to the advancement of knowledge through their meetings, publications and other resources. There are also included a number of more general organizations and special institutions supporting scientific research, as well as the constituent or affiliated societies of the three other national research councils of the United States—the American Council of Learned Societies, the American Council on Education and the Social Science Research Council. The Canadian section, compiled through the cooperation of the National Research Council of Canada, contains information concerning 143 organizations.

The handbook gives, in most cases, the president and secretary of the organization; the history, object,

membership, meetings, research funds and serial publications. A subject index to each section (United States and Canadian) includes a classification of the activities, funds, periodicals and changes of name as reported in the history. The fourth edition has a personnel index also for each section.

The information for the fourth edition was furnished by the organizations during the period from July 1, 1941, to January 15, 1942.

THE REORGANIZATION OF THE BUREAU OF MINES

Chemical and Engineering News gives an account of the reorganization of the essential operating structure of the U. S. Bureau of Mines to speed the expanded program of providing strategic and critical minerals for the nation's war needs. Three regional offices are being established at Salt Lake City, Utah, for the western states; at Rolla, Mo., for the central states, and at College Park, Md., for the eastern and southern states. Each office will be headed by a regional engineer and an assistant regional engineer, whose functions will be to supervise, initiate and execute approved investigations leading to the more rapid use of mineral resources in the region under their supervision. Under jurisdiction of the regional engineers will be district engineers assigned to states or districts within the respective regions, project engineers, other technologists and scientists and clerical and laboratory help. The regional engineers, under terms of the order, will take over all the functions and duties in the field previously assigned to the Mining, Metallurgical and Nonmetals Divisions of the Technologic Branch, which are now abolished. To advise the office of the director and to perform fact-finding functions and handle reports from the regional engineers, a Resources and Laboratories Service, containing a Mineral Processes Division, a Mining Division and a Laboratories Planning Division, has been established with a small staff in Washington.

The order also provides for the establishment of a Fuel and Explosives Service within the bureau, which will take over the Coal Division, the Petroleum and Natural Gas Division and the Explosives Division, all of which were part of the abolished Technologic Branch. Operation of the helium plant at Amarillo will be under the jurisdiction of the Petroleum and Natural Gas Division, as formerly. All laboratories working exclusively on petroleum or exclusively on coal will also operate under the chief of the Fuels and Explosives Service, as will sections of other laboratories devoted to petroleum, gas or coal. Other laboratories are transferred to the appropriate regional offices.

The Health and Safety Service of the bureau remains unchanged and will continue to include the Health, Safety, Coal Mine Inspection, Explosives Control and Mineral Production Security Divisions.

It is also reported in *Chemical and Engineering News* that a $500,000 electro-development laboratory, where U. S. Bureau of Mines metallurgists plan to study the recovery and processing of minerals from the Pacific Northwest with electrical energy from Bonneville and Grand Coulee Dams, will be established in that region within the near future. With part of the funds appropriated by Congress for the Interior Department, the bureau proposes to build and operate the new laboratory somewhere within a reasonable distance of the two government power plants to provide a long-term and diversified market for large supplies of energy. As soon as a location is selected—probably within a radius of 200 miles of the Bonneville and Grand Coulee Dams on the Columbia River—erection of the laboratory will be started.

The new station will be known as the Northwest Electro-Development Laboratory and will be staffed by 40 or 50 metallurgists and assistants. It will be equipped with electric furnaces and electrolytic cells of various types, ore-crushing and concentrating machinery, chemical laboratory and machine shop equipment and other miscellaneous installations. Operation of the completed laboratory will be in charge of R. S. Dean, assistant director of the bureau, with headquarters in Washington, D. C.

Investigations will be directed, among other things, toward improving existing or developing new methods of recovering magnesium metal from magnesite deposits. Production of aluminum from the abundant clays and alunite of that region will be probed thoroughly, as will methods to produce ferroalloys from tungsten, vanadium, manganese and chromium ores.

THE AMERICAN STANDARDS ASSOCIATION AND THE DEVELOPMENT OF WAR STANDARDS

THE Federal Government has entered into a contract with the American Standards Association for the use of the facilities of the association in the development of emergency or "war" standards for the War Production Board and the Office of Price Administration. The contract is being executed by the Office of Emergency Management on behalf of the War Production Board and the Office of Price Administration. Under it the American Standards Association is to provide services in creating standards which include one or more of the following items, and any other assignments or projects which may be requested by the Government which come within the scope of the association.

Nomenclature

Uniformity in dimensions to provide for interchange-

ability of parts and supplies or the interworking of apparatus
Specifications for materials and products
Methods of test or inspection
Methods of rating machinery or apparatus
Safety standards
Rules for the operation of apparatus or machinery
Concentration upon the optimum number of types, sizes, grades and colors.

The Simplification and Radio branches of the War Production Board and the Standards Division of the Office of Price Administration will supervise the work for the Government.

Under the contract the association will be reimbursed by the Government for the actual cost of the work undertaken specifically for the War Production Board and the Office of Price Administration. The object of the work is to further the war effort by making available to government and industry standards fitted to the present situation, so as to conserve scarce materials, to simplify production, to increase productive capacity and to conserve man-power. As outlined in the June issue of *Industrial Standardization*, the association is now engaged on more than thirty of these emergency projects, and the number of such undertakings is increasing steadily. Among these are specifications for radio materials and parts, requirements for gas ranges and hot water heaters, specifications for protective footwear, packages for electronic tubes and screw threads for high temperature bolts.

The contract is limited to $90,000 in any one fiscal year. Of this sum $60,000 is to be supplied by the War Production Board and $30,000 by the Office of Price Administration.

IN HONOR OF DR. MARSTON TAYLOR BOGERT

Honorary membership in the Society of Chemical Industry, as already noted in Science, was on July 10 conferred by order of the council on Dr. Marston Taylor Bogert. The citation of the council reads:

Marston Taylor Bogert, Professor Emeritus of Organic Chemistry at Columbia University, in commemoration of his life-long work as an inspiring teacher, a brilliant research worker and writer in the field of organic chemistry which branch of the science he has enriched beyond measure.

Born in 1868 and educated at Columbia College and Columbia School of Mines, he became Professor of Organic Chemistry at Columbia University in 1904, and has spent forty-seven years of his life on the staff where he displayed all the qualities of leadership. He is an Honorary LL.D. of Clark University and an Honorary Sc.D. of Columbia University. He was awarded the Nichols Medal of the American Chemical Society in 1905 and the Priestley Gold Medal of the same Society in 1938; was President of the American Chemical Society in 1907–1909 and President of the Society of Chemical Industry in 1912–1913. He is now a member of the National Academy of Sciences, of the National Research Council, President of the International Union of Chemistry and of many other of the most important chemical bodies in America and in Europe.

The Council in deciding to bestow this honor on the occasion of its sixty-first anniversary selected with great care one whom they considered worthy, for in addition to his valued contributions to our knowledge he has taken a lively interest in the international aspects of Chemistry and has through his genius for friendship done more than any other individual to break down the barriers of race and of prejudice.

The Seal of the Society of Chemical Industry was fixed in the presence of Wm. Cullen, *President;* L. H. Lampitt, *Honorary Treasurer;* Stanley Robson, *Honorary Foreign Secretary,* and H. J. Pooley, *General Secretary.*

SCIENTIFIC NOTES AND NEWS

Members of the committee recently appointed by President Roosevelt to report on the rubber situation, of which Bernard Baruch is chairman, are Dr. James Bryant Conant, president of Harvard University, and Dr. Karl T. Compton, president of the Massachusetts Institute of Technology.

At the annual meeting of the Society of Chemical Industry at the Royal Institution on July 10, the Messel Medal was presented to Sir John Russell, director of the Rothamsted Experimental Station and of the Imperial Bureau of Soil Science. He made an address entitled "Chemistry and Agricultural Reconstruction." At this meeting Dr. William Cullen was reelected president. In his address he reviewed the growth of chemical industry during the last fifty years.

The Albert Medal of the Royal Society of Arts for 1942 has been awarded to General J. C. Smuts, Prime Minister and Minister of External Affairs of the Union of South Africa. The following words will be inscribed on the medal: "Statesman. Soldier. Scientist. Philosopher." Among those awarded silver medals for papers read before the society during the past session was the Right Hon. Viscount Bennett, who gave an endowed lecture entitled "Empire Relations."

It is reported in *Nature* that the joint committee

consisting of representatives from the Royal Society of Edinburgh, the Royal Physical Society and the Royal Scottish Geographical Society has awarded the Bruce Prize to Dr. G. C. L. Bertram for valuable biological work in the Arctic and Antarctic during 1932–37; and especially for his work as biologist with the Graham Land Expedition during 1934–37, when he took part in the sledging journey which discovered King George VI Sound.

IN addition to the medals awarded by the Royal Geographical Society that were recorded in SCIENCE last week, the Murchison Grant was given to Dr. S. W. Wooldridge and David Linton, for their work on the structure and surface features of southeastern England; the Back Grant to Surgeon-Commander Murray Levick, R.N., for his organization of the Public Schools Exploration Society, and the Gill Memorial to Lieutenant-Commander L. C. Hill, for his services to geography in command of the R.R.S. *Discovery II.*

PROFESSOR C. L. FORTESCUE, professor of electrical engineering at the City and Guilds College, London, has been elected president of the Institution of Electrical Engineers for the year beginning on September 30.

AT the Atlantic City meeting of the American Society for Testing Materials, H. J. Ball, professor of textile engineering at the Lowell Textile Institute, was elected to succeed G. E. F. Lundell as president. P. H. Bates, chief of the Clay and Silicate Products Division of the National Bureau of Standards, was chosen vice-president to serve with Dean Harvey, materials engineer of the Engineering Laboratories and Standards Department of the Westinghouse Electric and Manufacturing Company, who was elected vice-president in 1941.

THE retirement is announced of Professor Frank M. Torrence, for thirty-one years a member of the department of mechanical engineering at the Pennsylvania State College, and of Dr. Albert H. Walton, associate extension professor of psychology, a member of the college staff since 1936. Among the new appointments are Millard V. Barton, associate professor of aeronautical engineering; R. L. McCormick, research assistant in petroleum and natural gas engineering; C. G. Seashore, assistant professor of engineering extension; R. J. McCall, assistant professor of agricultural engineering extension, and E. J. Walter, instructor in physics. Leave of absence has been granted to L. L. Newman, assistant professor of fuel technology, to serve with the War Production Board, and to G. E. Brandow, assistant professor of agricultural economics, to serve as consultant in the Office of Price Administration.

DR. E. A. EVANS, JR., associate professor and acting chairman of the department of biochemistry of the University of Chicago since September, 1941, has been appointed chairman of the department.

DR. GORDON H. SCOTT, associate professor of histology at the School of Medicine, Washington University, St. Louis, has been appointed professor of anatomy at the School of Medicine of the University of Southern California.

DR. E. L. MILLER, of the department of zoology at Louisiana State University, is on leave of absence for the 1942–43 session to teach at Lawrence College, Appleton, Wis.; Dr. Russell Coco has resigned to accept a position at the Oklahoma Agricultural and Mechanical College; Dr. Harry J. Bennett is on leave to serve with the U. S. Sanitary Corps. Dr. George C. Kent, Jr., of Vanderbilt University, and Dr. Arlie C. Todd, of the University of Nebraska, will fill the first two vacancies. A successor to Dr. Bennett has not been appointed.

DR. ALBERT F. BLAKESLEE, who retired last December as director of the Department of Genetics of the Carnegie Institution at Cold Spring Harbor, L. I., has been appointed by Smith College as William Allan Neilson professor for the academic year 1942–43 and as guest professor for the two years succeeding. He will be accompanied by Miss Sophie Satina and A. G. Avery, who will continue their cooperative investigations in cytogenetics. A large greenhouse (150′ × 30′), located between Northampton and Amherst, has been rented by Smith College for these studies for the three-year period. Properly qualified graduate students, both men and women, will be accepted for work toward an advanced degree under direction of the group. A limited number of part-time assistantships will be available to exceptional students who may register in the Graduate School of Smith College without payment of the regular tuition fees. Correspondence regarding these positions may be addressed to Dr. Blakeslee at Cold Spring Harbor, L. I., until September 12, and after that date at the department of botany, Smith College, Northampton, Mass.

DR. MEYER M. HARRIS, principal research internist of the New York State Psychiatric Institute, has received an additional grant-in-aid from the Committee on Scientific Research of the American Medical Association in support of work on the role of metabolic factors in neuromuscular diseases.

DR. ELDON W. LYLE, plant pathologist in rose disease investigations at the Tyler Substation of the Texas Agricultural Experiment Station, has been transferred to the substation at Temple, Texas, to work on Phymatotrichum root rot of cotton. The position at Temple has been held until recently by Dr. C. H. Rogers, who has resigned to serve as plant

pathologist with the Coker Pedigreed Seed Company of Hartsville, S. C.

DR. JOHN L. RICE, who was succeeded on July 16 as Health Commissioner of New York City by Dr. Ernest Lyman Stebbins, has been appointed deputy health commissioner at a salary of $7,000 a year.

CHARLES A. MABEY, physicist of the Bristol Company, Waterbury, Conn., has been appointed director of the research activities of the company.

W. W. DESCHNER, of the department of chemical engineering of the University of Kansas, has been appointed head of the division of chemical design, engineering and construction at J. F. Pritchard and Company, Kansas City, Mo.

IT is reported that an expedition to study cosmic rays, sponsored by the Academy of Sciences of the U. S. S. R., led by Professor A. I. Alikhanov, will be in the field for about six weeks making observations at the high-altitude meteorological station in the Alpaz mountains.

SCIENCE SERVICE reports that four scientific men from the Argentine will make a survey of industrial utilization possibilities of farm crops and wastes in the United States. The visit was arranged with the Government of Argentina by the State Department, the coordinator of Inter-American Affairs and the Department of Agriculture. Carlos Clementino Zarate and Oscar Saturnino Mallea, of the University of Santa Fé, both of whom are especially interested in problems of farm waste utilization, and Dr. Enrique Duprat, of the University of Buenos Aires, who will look into possibilities of industrial products from corn and wheat, have already arrived. At the end of the month they will be joined by José Baialardo, chemical engineer of the University of Santa Fé. Several weeks will be spent visiting the four regional laboratories of the Department of Agriculture at Philadelphia, Peoria, New Orleans and Albany, Calif., followed by six months of intensive research at whatever laboratory and in whatever line of work each visitor may select.

A SYMPOSIUM on synthetic rubber will be held by the American Chemical Society at the Buffalo meeting on September 9. Dr. E. R. Weidlein, director of the Mellon Institute and technical consultant on rubber of the Reconstruction Finance Corporation, will speak on "The Progress of Synthetic Rubber Production"; Albert L. Elder, of the Materials Division, War Production Board, on "The Progress of Butadiene Production," and Willard H. Dow, president of the Dow Chemical Company, on "The Progress of Styrene Production."

IN addition to the Training School for Electricians, already in operation at Iowa State College, the Navy will establish a Diesel school there. The college will furnish both instruction and buildings for the school, which will open about the middle of September.

A NEW cooperative program for industry and education has been initiated for chemists at the Illinois Institute of Technology. Fifty students have entered the first academic session of a cooperative course in chemistry, after completing sixteen weeks of work in industry, while a similar group will begin study in September. The program is the first of its kind in the Chicago area, having been organized only this spring. For the last seven years a similar course has been offered in mechanical engineering. Five hundred students are now included in that program. Plants cooperating hire the students in pairs so that one works while the other studies. The plan not only allows the students to earn a large part of their expenses while completing work for an engineering degree in five years, but also gives them the advantage of actual experience in industry. Standards are high. The student must be in the upper fourth of his high-school class to be considered an applicant and must pass aptitude and general tests before being finally admitted. The academic work of the program is done at the Lewis Institute.

IT is reported in *Nature* that a Free German Institute is being founded by the science section of the Free German League of Culture in Great Britain. The aims of the institute are: to uphold and develop the valuable traditions of the Free German research work and teaching; to provide for interchange of opinion between Free German men of science and those of the United Nations; to strengthen the German refugee youth in the spirit of international understanding and to enable them to help in reshaping Germany's cultural life after the destruction of Nazism. The opening session was held on July 17, when an address was given by Dr. Joseph Needham. Further particulars of the movement can be obtained from the secretary, Free German League of Culture, 36 Upper Park Road, London, N.W.3.

DISCUSSION

SWEDISH OCEANOGRAPHIC RESEARCH IN 1941

THE rotating "inertia currents" discovered by Swedish oceanographers in the Baltic Sea in 1931 have been further studied by Dr. B. Kullenberg in this institute in collaboration with Mag. I. Hela of Hels-

forskningsinstitutet of Helsingsfors, utilizing measurements from the last international cruise in July–August, 1939. The analysis of sustained observation series, partly from anchored ships, partly by means of recording meters below subsurface carrier buoys, prove the rotating current component of 12 pendulum hours' period to be practically of the same phase across the central Baltic, from the Swedish island Öland to near the coast of Lettonia. This implies that the whole surface watermass down to the thermocline near 20m:s depth is carrying out a rotatory movement with a horizontal amplitude up to 5 kilometres. In addition tidal currents of the M_2-period with a maximum velocity of 2 cm/sec. were for the first time ascertained to occur in the Baltic.

The vacuum core-sampler constructed by Pettersson and Kullenberg has been further developed. With a 2″ tube cores up to 12 metres long have been sampled from the Gullmar Fjord (115 m), and have been submitted to pollen analysis. Also from the Baltic coast cores of 7 metres length have been sampled with a shorter tube. They show distinct varves, also such of recent date, and thus promise to allow of a linking up of the post-glacial chronology of De Geer with our time. By means of a special contrivance it has been possible to make the length of the cores agree to within a few per cent. with the depth of submergence in the deposit, the cores being thus truly representative of the stratification *in situ*.

An examination of the radium content in manganese nodules from the Challenger expedition, central Pacific Ocean, has proved the very high content of the outermost layers, 10^{-10} gr Ra/gr, to decline rapidly inwards to quite low values near the nucleus. Apparently the Ra-ions attracted by the manganese, either from the sea water or from the surrounding sediment, show the characteristic decay of 1,580 years half-period. From the figures thus interpreted the rate of growth of the nodule is estimated at 1 millimetre in from 700 to 1,500 years. The more rapid growth to the upward direction, indicated by the convex shape of the largest nodule, is probably due to the accretion of sediment from above, the rate of sedimentation being thus found of the order 1 millimetre in 1,000 to 2,000 years, apparently the first estimate of the accumulation of red clay based on measurements. The figures are subject to a final revision on the conclusion of a more detailed study now in progress, where the radium content is being related, not to the gross weight of substance but to the content of manganese.

Preliminary measurements made several years ago on the vitamin D content in diatoms, collected in larger quantities during the spring increase here, had indicated the presence of considerable amounts of the antirachitic vitamin, which were, however, much increased by exposing control batches of the same diatoms to intense ultraviolet radiation from a quartz lamp. These investigations have now been resumed in collaboration with the new State Institute for Public Health of Stockholm, Director Professor Abramsson, where biological tests were carried out with diatoms collected from Bornö Station on the Gullmarfjord. The results were negative with non-radiated diatoms, probably owing to the available quantity being rather limited, whereas the same quantity of diatoms after uv-radiation gave a relatively high vitamin content, the oil extracted being even richer in the D-vitamin than codliver oil. It therefore seems likely that the vitamin D found in many marine organisms may in fact be identical vitamin D_3 and especially that the vitamin D available in phytoplankton and hence their value as primary foodstuff for marine organisms may depend on the ultraviolet daylight penetrating into the surface layers of the sea. This also suggests the tentative explanation for the preponderance of certain year-classes of food-fishes, and all it implies for the economic yield of the fisheries, that it may be due not only to the quantity of foodstuff available during the critical weeks in the existence of the fish-larvae (when their percentage of survival is largely determined) but also to its *quality, i.e.*, to the amount of vitamin D produced in the phytoplankton by the antirachitic daylight components reaching down to the plankton-bearing layers. Further research along these lines is now in progress.

HANS PETTERSSON,
Director

SVENSKA HYDROGRAFISK-BIOLOGISKA
KOMMISSIONEN AND OCEANOGRAFISKA
INSTITUTET I GÖTEBORG

THE FIRST LAW OF FLUORESCENCE

THERE have been comparatively few rules and so-termed laws formulated and proved for fluorescence and phosphorescence. Probably the best known is Stokes's Law, although others of a more specialized nature may be found in the literature of the field.

In photochemistry, the very basic rule is the Grötthuss-Draper Law. Grötthuss, in 1817, while investigating the fading of alcoholic solutions of ferric chloride and other iron salts, concluded that only light which is absorbed can act chemically. This rather obvious statement, now called the First Law of Photochemistry, at first attracted little general attention. Later the Grötthuss Law was independently rediscovered by Draper, in 1843, in the course of investigations on the photochemical combination of hydrogen

and chlorine.[1] Quantitative significance was given the Grötthuss-Draper Law by Van't Hoff, in 1904, during study of substance *transformations* by light of different intensities.[2]

In fluorescence an analogous situation may be considered to exist. However, the most fundamental law of fluorescence, and therefore of fluorochemistry, has not yet been formally defined, *i.e., energy must be absorbed by a luminescent system before emission can occur.* This patent statement most evidently concerns Stokes's Emission. In this connection, the exact status of Anti-Stokes's Emission and resonance radiation may provoke contention when close consideration is given this First Law of Fluorescence.

JACK DE MENT

The Mineralogist,
PORTLAND, OREGON

CEMENTING SINO-AMERICAN FRIENDSHIP

A STATEMENT contained in the recent letter by Egbert H. Walker on the subject of "Cementing Sino-American Friendship" possibly should be expanded. Dr. Walker's letter was concerned with the possibility of the collection of reprint material to be used as gifts to destitute Chinese libraries. He stated, "There seems at present to be no organization receiving and storing such unneeded literature for future distribution." His statement is true in respect to reprint material alone, but there is an organization in existence working on the question of preservation of scholarly and scientific materials for foreign libraries.

The American Library Association as early as December, 1940, created a Committee on Aid to Libraries in War Areas, headed by John R. Russell, librarian of the University of Rochester (reported in SCIENCE, March 6, 1942). During the past year and a half the committee has been working toward that time when reconstruction of foreign libraries can become possible. A rather extensive purchase program has been in process since July, 1941, and a campaign for gift material has been inaugurated on at least a small scale. The committee has had considerable publicity aimed at the conservation of important American scholarly journals, and through the publicity has received gifts from many institutions and individuals interested in the rebuilding of research resources in foreign countries.

The cooperation of a small group of American libraries scattered throughout the country has been enlisted on the question of storage space, and as gifts of journals have been offered, the committee has been able to issue shipping instructions for the transfer of this material to temporary storage, pending that time when foreign distribution can be accomplished.

With rather limited storage space, the committee has been doubtful as to the wisdom of attempting at the present time to collect book material and reprints. Considering the present state of the international situation, it is obvious that storage of this material may have to be for a matter of years, and although we can be sure what journal material will be of importance to foreign libraries, it is not as easy to predict the value of book and reprint material.

The committee would be very grateful for assurances that scholars in this country are keeping this future need in mind and are not destroying either journal, book or reprint material which they feel will be of value. In those instances where personal storage of this material is not possible, the committee would be very grateful for reports of what publications might be available and would undoubtedly be able to reach some satisfactory solution of the storage problem.

WAYNE M. HARTWELL,
Executive Assistant to the Committee
RUSH RHEES LIBRARY,
UNIVERSITY OF ROCHESTER

RESEARCH AS USUAL

ALTHOUGH few of us realize what the phrase means, we have been rightly told that "this is total war." As yet we have been called upon for only a small fraction of the sacrifice that will surely be necessary before the struggle is over. The longer we postpone doing the inevitable, the higher the cost will be, just as we are now paying heavily for our lack of foresight and sagacity a few years ago.

In this country a vast amount of time is still being spent on things that are of no immediate importance. A goodly fraction of that wasted effort could be devoted to work that will promote the success of our war struggle. In so far as it could be, it should be. To do anything else is at best short-sighted and at worst definitely unpatriotic.

Although many scientists in this country have already turned their attention to research work tributary to the war, there are still thousands who are going along just as in peace times, digging up facts that have no relation to the present emergency, studying problems not even remotely concerned with it, and burdening the mails with papers and books that deserve but little attention until this war has been won and our civilization saved from utter ruin.

Scientific research is of prime value in this crisis. Many of its good results are already well known. It is even possible that a single scientific discovery may tip the scales in favor of victory. But if one's accustomed field of research happens to be unrelated

[1] J. Draper, *Phil. Mag.*, 23: 401, 1843.

[2] F. F. Heyroth, "The Chemical Action of Ultraviolet Rays," 2d edition, page 206. New York: Reinhold Publishing Corporation. 1941.

to any war activity, he can surely turn part of his attention to some of the many other necessary things that any educated person can do.

Of course this is not a suggestion that all scientific work which is not directly connected with the war should be even temporarily abandoned. There are some investigations under way which may be important later on and which if not finished now will be entirely fruitless. There are certain projects that must be executed now or never, such as the geological survey in the valley of the Colorado River, that was made a few years ago before the rising waters of Lake Meade covered the scene forever. There may also be a few scientists who would be of so little value in any other occupation that they might as well continue at their usual work.

When allowances have been made for such exceptions, there still remains a large fraction of the available energy of the scientists of the country that could and ought to be diverted to the main purpose of saving the only type of civilization in which science can flourish and human happiness be widely attained.

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QUOTATIONS

SOCIAL MEDICINE

THE history of medicine is the story of a discontent which, from age to age, has infected the minds of practising physicians. One of the earliest manifestations of this discontent was the theory of the "four humours" enunciated by Hippocrates of Cos, in an attempt to explain the phenomena of disease and so to effect an improvement in therapy. Hippocrates made cure his measure of the understanding of cause and thus set the doctor upon the long way which, at this hour, he is still diligently treading. Those who followed have not at any time abandoned the Hippocratic outlook; but they have enlarged and broadened it so that the ideal of cure has become associated in their minds with the higher ideal of prevention. The names of Harvey, Sydenham, Jenner, the Hunters, Pasteur and Lister are held in honor as the architects of a world delivered from disease rather than of a world in which sick men can be restored to health. In the field of tropical medicine prevention has already so far eclipsed cure as to present a dazzling prospect of achievement; in the other fields the study of sources is reaching out towards a new vision of the doctor and his work. As the causes of disease are more precisely determined, it is seen that removal of these causes is the concern not of doctors only but also of all their patients, actual and prospective, that is to say of Government and the community.

It is this view of the matter which endows the great scheme of research founded by Lord Nuffield at Oxford six years ago with its peculiar interest and importance. Lord Nuffield, by establishing a new study of the causes of disease in surroundings calculated to stimulate the imagination and whet the edge of curiosity, effected such a welding of science and sociology as even the most optimistic had not dared to hope for within the compass of a generation. The Oxford school began to express the view, illustrated in a recent Harveian oration by Sir Farquhar Buzzard, that social medicine has been and is being neglected in this country, and that the time has come for an organized investigation of the social factors in many obscure problems of causation by a force of doctors specially trained for the purpose. Action has now followed. With the cordial approval of Lord Nuffield, the Nuffield Provincial Hospitals Trust has decided to devote the sum of £10,000 a year, for ten years in the first instance, to the creation of a university professorship of social medicine in Oxford University, and to the foundation of an institute in which the professor will work.

The purposes of the new institute are three-fold—to investigate the influence of social, genetic, environmental and domestic factors on the incidence of human disease and disability; to seek and promote measures, other than those usually employed in the practice of remedial medicine, for the protection of the individual and of the community against such forces as interfere with the full development and maintenance of man's mental and physical capacity; and, if required by the university to do so, to make provision in the institute for the instruction in social medicine of students and practitioners approved by the board of the faculty of medicine in the university. A chief merit of this plan is the promise which it affords of a solid foundation for future legislative action. For the truth must be faced that such a foundation does not exist at present and can not be attained except by diligent work. Schemes of reform or coordination are likely to fail of their object if initiated hastily without a true understanding of the issues involved and the difficulties certain to be encountered. Social medicine is not an exclusive province of government; it belongs also to all the local areas and even to all the workers in these areas. Only experience can direct the march of a progress which must in present conditions be pioneering work. The trail must be blazed. Upon the new institute at Oxford University will devolve the heavy responsibility and the high honor of blazing it.—*The Times, London.*

SCIENTIFIC BOOKS

THE RAT IN LABORATORY INVESTIGATION

The Rat in Laboratory Investigation. By JOHN Q. GRIFFITH and EDMOND J. FARRIS, editors, and thirty contributors. 488 pp. 178 illustrations. J. B. Lippincott Company, 1942.

THIS book, being the product of many workers, has all the strength and weakness of that form of writing. Each author treats his topic from his own point of view and with little regard for the contributions of the others. The chapters are therefore of very different lengths—5 to 76 pages—quite regardless of the relative importance of the topics, and the general treatment varies in the same way. Some of the chapters are excellent—others much less so, but in general the average is high.

An inspection of the various chapters shows that, with few exceptions, they are concerned with experimental procedures. The first of these, by Edmond J. Farris (17 pages), gives the standard procedures of the Wistar Colony, now perfected after years of experimentation. It is called "Breeding the Rat." The next, "General Methods," by John Q. Griffith (5 pages), which deals almost entirely with anesthesia, follows. Then comes one of the non-experimental chapters on "Gross Anatomy" (28 pages), by Eunice C. Green, a brief account of normal structures in preparation for later chapters. An introduction to the "Experimental Methods and Rat Embryos" (28 pages) by J. S. Nicholas comes next. This is largely an account of normal development. Then follows a treatise (36 pages) by Richard H. McCoy, dealing with the dietary requirements of the rat. In this the various substances are considered separately, with a summary at the end and a long, condensed bibliography. Following this is an account of the teeth (63 pages), by Isaac Schour and Maury Massler, including the effects of various agents upon their development. This has also a fairly long bibliography. Then comes a brief account (13 pages) by Thos. E. Machella and J. Q. Griffith on "The Digestive System," which is almost entirely experimental. This is followed by another account on "Metabolism" (13 pages), by C. Jelleff Carr and John C. Krantz—carbohydrate, fat nitrogen and respiratory metabolism—with reference, in the final sections, to the effects of operative procedures and drugs upon metabolism. A short chapter (8 pages) on the "Central Nervous System," by W. A. Jeffers, J. Q. Griffith and E. Roberts, deals with various operations. Then follows a long section (76 pages) on "Techniques for the Investigation of Psychological Phenomena," by George L. Kreezer, well organized alphabetically under headings, with cross references. This has the longest bibliography of any in the book. Next there is a chapter on the "Circulatory System" (17 pages), by J. Q. Griffith, W. A. Jeffers and E. Roberts, in which are considered various experimental procedures. A short chapter (7 pages), dealing with the use of the rat in biological assay, follows. Then comes a long chapter (55 pages) on "Dosage of Drugs," by Harald G. O. Holck and Donald R. Mathieson. This is largely a tabular arrangement, preceded by a discussion of some general conditions and followed by a long bibliography. The chapter on "Haematology of the Rat," by Adolph J. Creskoff (16 pages), takes up methods and draws comparisons with human blood. The fifteenth chapter deals with the use of x-rays (16 pages) and is largely a series of pictures. The next section deals with the topic of "Surgery" (19 pages), by Dwight J. Ingle, John Q. Griffith, W. A. Jeffers, M. A. Lindauer, H. U. Hopkins and Albert Segaloff, and presents a series of operations in detail. Then comes a chapter given to "Histological Methods" (7 pages), by W. H. F. Addison—fixing, imbedding and staining. "The Osseous System," which follows (22 pages), by R. M. Strong, is general in character and consists in the description of methods for gross and microscopic preparations. The chapter on "The Eye" is the shortest in the book (5 pages) and is by W. E. Fry. Then comes a section on the "Protozoan Parasites" (13 pages), by D. H. Wenrich, divided into those of the digestive tract and of the blood and tissues. Following this is a chapter on "Metazoan Parasites" (14 pages), by Herbert L. Ratcliffe, arranged according to the type of animal parasites. Finally there is a chapter on "Spontaneous Diseases of Laboratory Rats" (15 pages), also by Herbert L. Ratcliffe, in which are considered various rat diseases.

From this brief review it is apparent that the present work is a practical compilation of some of the more important phases of rat technique. It deals almost entirely with methods and procedures—it is a worker's hand book and, as such, forms an indispensable guide. In the very nature of its preparation it can not be complete and well rounded, and even, in the detail of bibliography, each author follows his own ideas. The many illustrations are good and the format and typography are excellent.

C. E. MCCLUNG

STELLAR DYNAMICS

Principles of Stellar Dynamics. By S. CHANDRASEKHAR. x + 251 pp. Illustrated. Chicago: University of Chicago Press. $5.00.

THE latest addition to the Astrophysical Monographs sponsored by the *Astrophysical Journal* is an important volume by Dr. S. Chandrasekhar, of the University of Chicago and the Yerkes Observatory. Through his studies of the dynamics of a rotating

galaxy and of the dynamics and statistics of encounters between stars Dr. Chandrasekhar has become one of the leading authorities in the field of galactic dynamics. In the new volume he has blended his own researches and those of others in a well-rounded book, which should for many years to come be "must" reading for every prospective student of galactic structure and dynamics.

The book opens with a chapter on "Kinematics." Beginning with a brief analysis and descriptions of the properties of stellar motions for the regions in the immediate vicinity of the sun, the author describes the phenomena of galactic rotation and of the asymmetry in stellar motions for high velocity stars. The chapter closes with a survey of the properties of external galaxies and a brief mention of some characteristics of star clusters.

In the second chapter, "The Time of Relaxation of a Stellar System," we find a clear discussion of the effects of stellar encounters. The presentation follows closely that of a series of papers by Chandrasekhar and Williamson. Even in the two-body approximation the problem is quite complex. No attempt has been made to extend the analysis so as to include the effects of multiple encounters by adapting the theory of fluctuations to the stellar case. A first trial in this direction has recently been made by Chandrasekhar and von Neumann, but the two-body approximation will probably remain important for rough estimates for many years to come.

The dynamics of a stellar system with differential motions, such as our own galaxy, is presented in the third chapter. The treatment follows closely that of the author and many astronomers will be delighted to have here an authoritative summary of Chandrasekhar's earlier papers.

The discussion of the dynamics of stellar systems is contained in the fourth chapter, in which special attention is given to the dynamical interpretation of spiral structure. The sections on Lindblad's theory of spiral structure, which present a fair and critical evaluation of current achievements and remaining difficulties, will probably be more widely read than any other part of Chandrasekhar's volume.

The book closes with a chapter on the dynamics of star clusters. The problem of globular clusters receives only scant attention, but the treatment of galactic clusters is quite complete and excellently written. In this chapter Chandrasekhar indicates in which way the theories for the dissolution of galactic clusters under the influence of the shearing forces of galactic rotation must be adapted in order to include the effects of encounters between cluster members.

At the conclusion of every chapter there appear bibliographical notes that contribute much to the general value of the volume. A detailed subject index and some appendices will undoubtedly prove very useful.

Chandrasekhar's volume comes at a time when there exists a real need for a book on stellar dynamics. Research in this field has recently developed along rather divergent lines and none of the books published during the past ten years has succeeded in providing a unified treatment. Chandrasekhar's book does this for the first time. Some of us who have worked in the field of galactic dynamics might here and there have preferred a somewhat different approach, but when it comes to judging the book as a whole we all pay our respects to the skill and insight of the author.

This book should exert a profound influence on the future developments in the field of galactic dynamics. I can recommend its study unreservedly to newcomers in the field and to those who already have a passing acquaintance with its problems. The experts can profit from reading it. If I were stranded in a far-off prison camp where I would be allowed one book I would ask for Chandrasekhar's volume. I am sure that per ounce of paper it would provide the most stimulation for continued research in theoretical astronomy.

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Harvard College Observatory

SPECIAL ARTICLES

TREATMENT OF EXPERIMENTAL RENAL HYPERTENSION WITH VITAMIN A

Recently Pena and Villaverde reported favorable results in the treatment of essential hypertension in man with large doses of vitamin A orally.[1] Several case histories confirmatory of this finding have been reported to the senior author by medical colleagues. In view of these reports and the many similarities between experimental renal hypertension in the dog and essential hypertension in man, inclusive of a probable partial common pathogenesis, we have studied the effect of vitamin A by mouth in experimental renal hypertension in dogs. This report summarizes our preliminary results.

Five dogs were rendered hypertensive by the Goldblatt technique[2] and the resulting hypertension was permitted to stabilize over a period of five to eight months. Mean blood pressure readings were obtained by puncture of a femoral artery two to three times a week. Studies on the blood urea nitrogen, urinalyses and determinations of body weight were made at monthly or bimonthly intervals. Three of the dogs

[1] J. Govea Pena and M. Villaverde, *Rev. Cubana Cardiol.*, 2: 322, 1940.

[2] H. Goldblatt, J. Lynch, R. F. Hanzal and W. W. Summerville, *Jour. Exper. Med.*, 59: 347, 1934.

were treated daily with 200,000 units of vitamin A dissolved in 1 cc of sesame oil[3] by mouth for three months, followed by 400,000 units of vitamin A in 2 cc of sesame oil for an additional three months. The other two dogs served as controls and were given oral daily doses of 1 cc of sesame oil for three months, to be followed by 2 cc of sesame oil for another three months. A limited number of blood serum vitamin A determinations (method of McCoord and Luce-Clausen[4]) were made on these five animals and on two untreated normotensive and two untreated hypertensive dogs.[5]

Striking reductions in the blood pressures were observed in each of the three dogs treated with vitamin A. The results for the first dog, which are typical for the other two animals, are illustrated in Fig. 1. The normotensive blood pressure range for this dog, which weighed 16 Kg., was 100–120 mm Hg. Following bilateral constriction of the renal arteries, the dog developed a hypertension which ranged from 150–180 mm Hg. during the succeeding eight months. During the second week of vitamin A therapy, the blood pressures of the animal decreased approximately 20 mm Hg. and then ranged from approximately 120–140 mm Hg. for the remainder of the first three months of treatment. Three additional months of therapy just completed at the increased dosage of 400,000 units of vitamin A daily resulted in a further gradual reduction in blood pressure to the normotensive level of 100–120 mm Hg. The blood pressures of the second dog, which weighed 12 Kg., were similarly reduced from a hypertensive range of 190–210 mm Hg. to the pre-constriction normotensive level of 130–140 mm Hg. The blood pressures of the third dog weighing 15 Kg. were decreased from a hypertensive range of 150–170 mm Hg. to a level of 130–150 mm Hg. during the second week of vitamin A therapy and have remained in this range to date (third month of treatment).

The two control dogs treated with sesame oil have thus far shown no significant changes in their hypertensive levels of 150–170 mm Hg. and 160–180 mm Hg., respectively. Moreover, we have never seen spontaneous blood pressure decreases similar to the reductions observed in the three dogs treated with vitamin A in 75 renal hypertensive dogs during the past three years.

Serum vitamin A determinations on the untreated normotensive and hypertensive dogs showed values of 40–70 units per 100 cc. During vitamin A therapy the serum vitamin A values of the three dogs varied from approximately 500–3,000 units per 100 cc, whereas the two dogs given sesame oil ranged from 40–70 units per 100 cc.

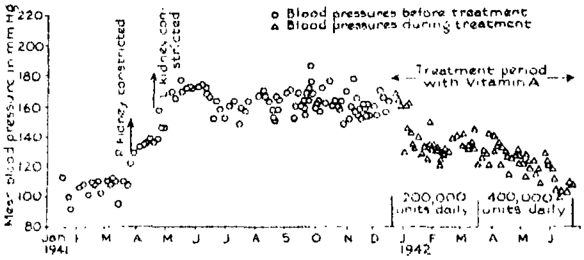

FIG. 1

No toxic effects from the vitamin A therapy were detected in any of the animals, although our present observations do not rule out this possibility. The appetites of the dogs remained excellent, their weights constant, and their blood urea nitrogens and urines normal throughout. The two dosage levels of vitamin A used were somewhat less than 1/20 and 1/10 of the amounts reported toxic for rats by some workers[6, 7, 8] but less than 1/100 and 1/50 of the toxic levels reported by others[9, 10] who contend that the lower values of the former investigators are due to impurities.

The mechanism of the striking reductions in the blood pressures of these three renal hypertensive dogs by high dosage vitamin A therapy is obscure. We have seen no evidence of hypovitaminosis A in experimental renal hypertension in dogs, and the few serum vitamin A determinations reported above are confirmatory in this respect. The fact that vitamin A in high dosage has been shown to raise the urea clearance of dogs 40 per cent. above normal[11] suggests that vitamin A in large doses may disturb the pathophysiologic pressor mechanisms produced by renal artery constriction. The antihypertensive action of vitamin A in experimental renal hypertension may, of course, be totally unrelated to its specific vitamin effects. Indeed, one or more chemically related compounds with little or no vitamin A action may prove to be more effective than vitamin A as hypotensive agents. The vitamin A preparation used contained traces of impurities. The unlikely possibility that one or more of these impurities is responsible for the reductions in blood pressure must be investigated.

In any event, we purpose to enlarge considerably this preliminary study of vitamin A in experimental

[3] Generously supplied by Dr. J. B. Rice, Department of Medical Research of the Winthrop Chemical Company.

[4] A. B. McCoord and E. M. Luce-Clausen, *Jour. Nutrition*, 7: 557, 1934.

[5] We are grateful to Dr. H. P. Popper, of the Department of Pathology, for these determinations.

[6] G. Domagk and P. von Bobeneck, *Virch. Arch. of Path. Anat.*, 290: 385, 1933.

[7] W. von Drigalski, *Klin. Woch.*, 12: 308, 1933.

[8] H. Popper and S. Brenner, *Jour. Nutrition*, 23: 431, 1942.

[9] E. B. Vedder and C. Rosenberg, *Jour. Nutrition*, 16: 57, 1938.

[10] I. Ikegaki, *Ztschr. f. Vitaminforsch.*, 7: 113, 1938.

[11] R. C. Herrin and H. J. Nicholes, *Am. Jour. Physiol.*, 125: 786, 1939.

renal hypertension and also to determine the possible antihypertensive effects of other compounds chemically related to vitamin A.

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RENAL HYPERLIPEMIA IN DOGS

Observations made in studies on children suffering from nephrosis gave rise to the question whether or not the kidney itself may exert a regulatory influence on the blood lipids, disturbance of which could lead to the hyperlipemia manifested in nephrosis. This problem was studied by determining the content of total fat and of total and free cholesterol in the blood serum of 18 dogs which had been subjected to nephrectomies[1] or to subcutaneous injections of bichloride of mercury, uranium nitrate or potassium bichromate.

Bilateral nephrectomy, performed on three dogs, was followed by a continuous rise in the level of serum cholesterol. The effect observed in one of these dogs after the second kidney had been removed is shown in

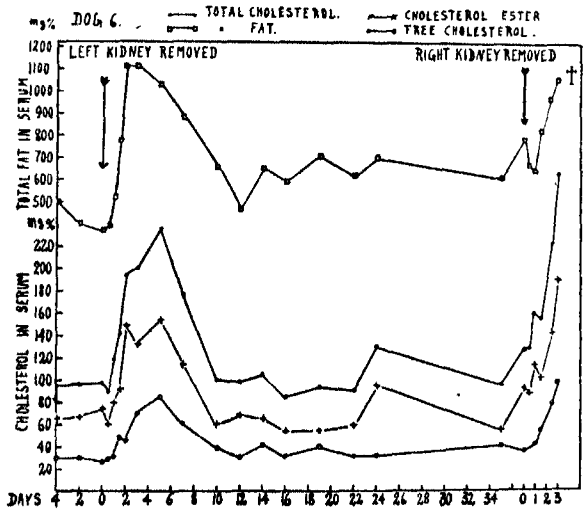

Fig. 1

Fig. 1. It can be seen that the total fat content increases beyond the extent that could be accounted for by the increase in cholesterol, thus indicating that lecithin and probably also fatty acids and neutral fat participate in this increase.

The effect of unilateral nephrectomy was studied in two dogs. In both animals the level of blood lipids rose for from 4 to 7 days and then returned to normal in 12 or 14 days after the operation (Fig. 1). The increase is obviously connected with the sudden removal of one kidney, while the return to normal level may well be due to the subsequent hypertrophy of the remaining kidney. A sham operation performed as control did not influence the blood lipid level.

In 10 dogs a single dose of bichloride of mercury administered subcutaneously was followed in every instance by an increase in the content of total fat as well as of free cholesterol and cholesterol ester. One lethal dose of 16 mg per kilogram of body weight led to a continuous increase until death. When a smaller dose was injected, however, the resulting hyperlipemia subsided and the values returned to normal. The results of one of the eight experiments carried out with a single injection of 5 mg of bichloride of mercury per kilogram of body weight are shown in Fig. 2. The resulting hyperlipemia is not

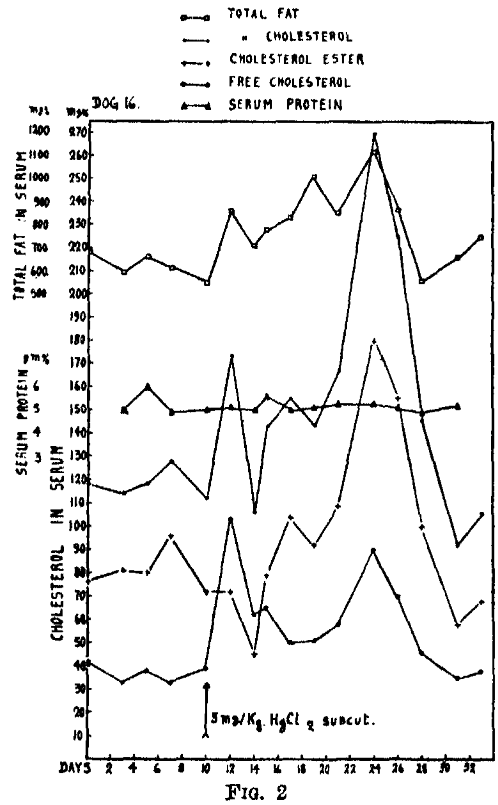

Fig. 2

accompanied by a decrease in the content of serum protein. This observation is of importance in connection with the theory which explains the hyperlipemia in nephrosis on the basis of hypoproteinemia. A smaller dose of bichloride (2 mg per kilogram of body weight) was injected intramuscularly in two other dogs twice a week for between three and four weeks. In these dogs hyperlipemia developed slowly and the level of total fat and of cholesterol continued to rise as long as the injections were given.

Subcutaneous injection of potassium bichromate (7 mg per kilogram of body weight) in one dog and of uranium nitrate (6 mg per kilogram of body weight)

[1] I am indebted to Dr. Harry Goldblatt and Dr. Joseph R. Kahn, of the Institute of Pathology, School of Medicine, Western Reserve University, for performing the operations on the dogs.

in another dog also brought about an increase in the content of total fat and cholesterol in the blood serum to over 100 per cent. of the original amount.

Conclusion: The tubular apparatus of the kidneys of dogs possesses a regulatory influence on the blood lipids such as has hitherto been unknown and is still unexplained. It is probable that the human kidney exerts the same function, but this has not yet been proved. A disturbance of this function would explain the hyperlipemia observed in nephrosis better than any hypothesis thus far advanced.

WALTER HEYMANN

BABIES AND CHILDRENS HOSPITAL, AND DEPARTMENT OF PEDIATRICS, SCHOOL OF MEDICINE, WESTERN RESERVE UNIVERSITY, CLEVELAND, OHIO

ASSOCIATION OF TOBACCO LEAFSPOT BACTERIA WITH ROOTS OF CROP PLANTS[1]

SINCE the discovery, more than 20 years ago, of the causal agents of wildfire (*Bacterium tabacum* W. and F.) and angular leafspot (*B. angulatum* F. and M.) diseases of tobacco, no satisfactory explanation of the sources of inoculum in tobacco plant beds has been advanced. Even if a new plant-bed site is used, the plant-bed soil steamed or burned, a new cotton cover used, and disease-free seed planted, angular leafspot and, to a less extent, wildfire may appear throughout an entire Burley tobacco bed or large sections of it after a few hours of cool, wet weather. The fact that the amount of disease is usually so great seems to eliminate the possibility that the bacteria might have originated in trash from a previous infected tobacco crop. One fact is known which has a bearing on the source of inoculum; namely, that one or two applications of Bordeaux mixture sprinkled on the surface of the soil when the plants are very small or even before the seeds germinate will completely protect the leaves from infection in the bed.

In searching for the source of inoculum we found that,[2] in field soils naturally contaminated with these organisms from a previous infected crop, the organisms survived the winter at least until plant-bed time, and could be isolated by proper technic. The same was true of plots of soil out-of-doors artificially inoculated in the fall. Attempts to isolate the organisms from plant-bed soil in the spring of 1941, however, where subsequently one or the other disease developed, resulted only in failure. Occasional failure also resulted in attempts to isolate the organisms from artificially and naturally contaminated soil in which cover crops were growing. These erratic results suggested that the bacteria might be living on or in the roots of cover crops in the contaminated soil and that infection of leaves in the plant bed might follow multiplication of the bacteria on the roots of young tobacco or other plants growing in the bed.

In testing this hypothesis it was found that heavy infection frequently resulted when the roots of cover crops, including wheat, barley, rye, crimson clover and vetch, were washed free from soil in running water, ground in a mortar, diluted with water and poured over the surface of artificially water-soaked tobacco leaves. The roots were obtained both from artificially contaminated soils out-of-doors and from fields where the diseases were known to have been severe in 1941. Roots of tobacco from plant beds naturally infected with wildfire or angular leafspot also gave heavy infection when washed and used as inoculum. *B. angulatum* has also been isolated from the roots of seedling tobacco plants before the disease appeared on the leaves in untreated beds, and has been isolated from the roots of tobacco plants in beds treated with Bordeaux mixture. It is likely, therefore, that both organisms may be carried from the plant bed to the field on the roots of "healthy" plants and be the source of sudden outbreaks in the field following a protracted period of wet weather.

A microscopic examination of tobacco rootlets from naturally infected plant beds and from artificially inoculated tobacco roots growing in sand revealed masses of bacteria, at intervals on the roots, which appeared to be embedded in a matrix, for occasional bacteria which became separated from the surface developed motility while the others showed no movement whatever. Bits of roots bearing these colonies when used as inoculum produced heavy infection of either angular leafspot or wildfire, depending on the source, on water-soaked tobacco leaves.

The causal bacteria of these diseases can maintain themselves on the roots of several unrelated crop plants for at least six months, and can under certain natural conditions cause specific leafspot diseases of several unrelated plants, such as tobacco, tomato, morning-glory and cowpeas. These results seem to give support to the belief that the senior writer has had for many years; namely, that these bacteria are not primarily tobacco pathogens. They appear to be common (but specific) organisms present on roots, perhaps of native vegetation, which can and do, under special favorable circumstances, cause specific leafspots of tobacco.

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E. M. JOHNSON

S. DIACHUN

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[1] The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the director.

[2] S. Diachun, W. D. Valleau, E. M. Johnson, *Phytopathology*, 32: 2, 1942.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

APPARATUS FOR THE PRODUCTION OF ARTIFICIAL FROST INJURY IN THE BRANCHES OF LIVING TREES[1]

NATURAL late frost injuries have been used by Glock in the past to determine the presence of multiple growth layers (or "rings") in one year in the branches of living trees. In connection with this work Studhalter suggested that, to serve the same purpose, an apparatus be devised for the production of artificial frost injury under controlled conditions.

The resulting apparatus has certain advantages over other types described by Sorauer[2] and by Mix[3] for application to a portion of a branch. These advantages include ease of application to branches, use of solid carbon dioxide (dry ice), which permits a wide range of low temperature, and the simulation of natural conditions in which the freezing element does not come into direct contact with the plant tissue.

The apparatus, square in cross section, is made of half-inch seasoned lumber and consists of three essential units (Fig. 1), namely, lid, dry-ice chamber and treatment chamber. Sheet cork gives insulation on the interior and aluminum paint on the exterior. Rubber gaskets are placed on all surfaces where the units come in contact.

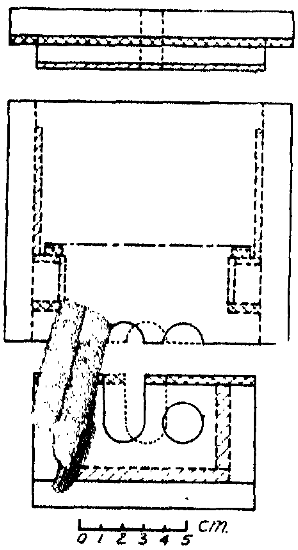

Fig 1. Diagram of apparatus

—— wire shelf
- - - - on inner face of apparatus
.... on opposite end of apparatus
////// cork lining
XXXXX rubber gasket

FIG. 1

A 1-cm hole through the center of the lid permits the escape of air at the beginning of an experiment and, later, of the carbon dioxide gas as it is pushed upward by the descending colder gas. In the dry-ice chamber a wire screen supports the solid carbon dioxide which is placed in the upper part of the unit. The wire screen rests on a rubber gasket made discontinuous in order to allow free passage of carbon dioxide gas into and out of the lower unit. The treatment chamber fits up into the bottom of the dry-ice chamber. In one side of the treatment chamber a hole receives a low-temperature thermometer held firmly by a cork. Into each of two sides, as shown in the figure, a channel is cut to receive the branch, the one on the same side as the thermometer hole being offset from the middle. Sponge rubber gaskets are cemented into the channels so as to fill them nearly to the top.

An apparatus with the dimensions shown in Fig. 1, which is drawn to scale, will receive branches up to 12 mm in diameter. When the apparatus is applied in the field, the treatment unit is brought up from below to the part of the branch to be frozen so that the branch sinks into the sponge rubber of the channels. Separate blocks of sponge rubber are inserted into the channels on top of the branch. Then the other units are lowered into place and the whole held together by strong rubber bands. If necessary for adequate support, a cord may be passed around the apparatus and over a superjacent limb.

It has been found by experiments during the past two years that the range of temperature obtainable extends from 0 to −45 degrees C. for an interval up to 7 hours. In order to obtain different temperatures, the following factors are varied as the experiments demand: absolute quantity of dry ice, size and number of pieces (to determine the amount of surface exposed), length of time of application and degree of pre-cooling. Extensive calibration studies prove that the dry-ice chamber should be above the treatment chamber for the most effective results.

Throughout two field seasons the apparatus has been used for anatomical and ecological field experiments and for the study of cambial activity especially during and after freezing. It has proved its efficacy in the duplication of natural frost injury and in the placement of an internal label whereby growth flushes are being timed and the number of growth layers determined.

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LUBBOCK

[1] Presented at the Dallas, Texas, meetings of the American Association for the Advancement of Science, on December 29, 1941. Abstract in *Amer. Jour. Bot.*, 28 (10, Sup.): 6s, 1941.

[2] P. Sorauer, *Ber. deut. bot. Ges.*, 2: xxii–xxv, 1884.

[3] A. J. Mix, N. Y. (Cornell) *Agr. Exp. Sta. Bul.*, 382: 235–284, 1916.

THE USE OF TERTIARY BUTYL ALCOHOL IN MICROTECHNIQUE

TECHNICIANS, always interested in improving microtechnique by using new reagents, are especially anxious to conserve materials vital to war industry. Tertiary butyl alcohol (TBA) is used partially to replace dehydrating agents such as ethyl alcohol and clearing agents such as xylol and benzol, which are becoming increasingly expensive and difficult to obtain. TBA is obtainable without priority rating,[1] is cheaper than most laboratory reagents,[2] and safe to

[1] According to R. W. Greeff and Company, 10 Rockefeller Plaza, New York, N. Y.

[2] Based on list prices of the California Botanical Materials Company, 787 Melville Ave., Palo Alto, Calif.

use if prolonged exposure to a high concentration of vapors is avoided. TBA is miscible with most reagents in common laboratory use.

TBA was first introduced as a dehydrating agent for tissues by Johansen.[3] Although it has been recommended for plant microtechnique,[4,5] little has been written regarding its use for animal tissues.[6] During the past seven years I have found TBA unusually satisfactory for the dehydration of a large variety of normal and pathological mammalian tissues. A comparative study[7] of dehydrating agents showed that it caused less shrinkage of rabbit kidney than dioxan, xylol or chloroform. After TBA dehydration tissue hardening is comparatively slight and cytological details are well preserved.

Although techniques should be varied to suit the size and type of specimen, the following schedules have been found generally satisfactory. For dehydrating tissues a series of solutions of tertiary butyl-ethyl alcohol (TBEA) should be prepared as indicated in Table 1.

TABLE 1

PERCENTAGES OF TBEA SOLUTIONS

Constituents	50 per cent.	70 per cent.	85 per cent.	95 per cent.	100 per cent.
Distilled water	50 cc	30 cc	15 cc	....	....
95 per cent. ethyl alcohol	40 "	50 "	50 "	45 cc	....
Tertiary butyl alcohol	10 "	20 "	35 "	55 "	75 cc
Absolute ethyl alcohol	....	....	....	....	25 "

Fixed material dehydrated directly from water or through the lower percentages of ethyl alcohol is transferred to 50 per cent. TBEA for 1–2 hours and material washed in alcohol is placed in the corresponding concentration of the TBEA dehydrating mixture. Leave tissues in (1) 70 per cent. TBEA from 2 hours to several days; (2) 85 per cent. TBEA, 1–2 hours; (3) 95 per cent. TBEA, 1–2 hours; (4) 100 per cent. TBEA, 1–3 hours; (5) pure TBA, three changes in 4 hours to overnight; (6) equal parts of pure TBA and paraffin oil, 1–2 hours; and (7) infiltrate with paraffin. This infiltration is accomplished by filling shell vials three-fourths full of melted parowax or paraffin, allowing the paraffin to solidify and then placing the tissue just covered with TBA-paraffin oil mixture on top of the solid paraffin. The vials are then placed in a well-ventilated oven, the temperature of which is several degrees above the melting point of the paraffin. As the paraffin melts the tissue sinks and is gradually infiltrated with paraffin. Starting at least one hour after the tissue has sunk to the bottom of the vial, the melted paraffin should be changed at hourly intervals, at least until the odor of TBA is no longer detectable, usually 2–6 hours. The used paraffin is discarded. If a special paraffin is used for embedding, it should be used as the last change of melted paraffin in the oven. When necessary, very small pieces of tissue which are in 70 per cent. TBEA one morning may be dehydrated during the day, infiltrated with paraffin overnight and sectioned by noon the next day.

The two most important stages in the technique are the final dehydration with TBA and the infiltration with paraffin. It is essential that the free water be removed completely from the tissue before paraffin infiltration and that the TBA and paraffin oil have diffused from the tissues before they are embedded. Although it is better to discard all solutions after using once, if necessary the same solutions may be used several times.

When celloidin or paraffin-celloidin (double embedding) techniques are being used, after dehydration in 100 per cent. TBEA, tissues may be treated according to the usual schedules with ether-alcohol and infiltrated with celloidin or nitrocellulose. Johansen[4] has suggested the use of equal parts of tertiary butyl, ethyl alcohol and ether instead of the usual alcohol-ether as a solvent for celloidin or nitrocellulose.

Since many stains are less soluble in TBA than in ethyl alcohol, TBA is used in dehydrating stained sections, especially when one is anxious to reduce the extraction of ethyl alcohol soluble stains from the tissues.[8] Slides are mounted with balsam, damar or clarite directly from TBA or preferably after passage through xylol or toluol. Celloidin and nitrocellulose are only slightly soluble in TBA, and stained celloidin sections can be dehydrated directly through TBA or TBA with chloroform into xylol before mounting.

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[3] D. A. Johansen, SCIENCE, 82: 253, 1935.

[4] D. A. Johansen, "Plant Microtechnique," McGraw-Hill Book Company, New York, 1940.

[5] J. E. Sass, "Elements of Botanical Microtechnique," McGraw-Hill Book Company., New York, 1940.

[6] R. E. Stowell, *J. Techn. Methods*, 22 (in press).

[7] R. E. Stowell, *Stain Techn.*, 16: 67, 1941.

[8] N. D. Levine, *Stain Techn.*, 14: 29, 1939.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE IMPORTANCE OF REST PERIODS

Rest periods are vital to war production. This is stressed by the War Department, the Navy Department, the War Manpower Commission, the War Production Board and four other Government agencies in recommendations to war contractors.

America is at war and the ordinary leisurely summertime vacations are naturally out for the duration just as touring and sightseeing are out. There can be no slacking of production, no relaxing of speed, no shutdown of any department that is needed in war production. But rest periods are important for each war worker. They should be carefully planned over the whole year or the longest possible period. In this way fresh, rested reinforcements are constantly being brought into service on the production front. Each day should have its rest periods. A 30-minute period for lunch is recommended by the Government departments. In occupations that involve contact with poisonous substances, workers must also be allowed time to wash up before lunch.

Industrial psychologists have found that the amount of rest and the frequency of the periods required for peak efficiency depends a great deal on the type of work being done. It should be carefully planned for each sort of job in a plant. In some work a compulsory ten-minute rest interval every two hours is best. In other types of work, it may be best to allow each individual to select his own time to take such a short rest period when he feels fatigued. According to the statement of the Government officials, "One scheduled day of rest for the individual, approximately every seven, should be a universal and invariable rule."

This does not mean any shut-down on Sunday. Plants and tools should be kept busy all around the clock and all around the calendar. But for the individual, a 7-day work week is injurious to health, to production and to morale, the statement emphasizes. Only in extreme emergencies should either workers or supervisors go without the weekly day of rest. Then it must be only for a limited time.

Psychologists would point out that this is even more important for the executive who does not need to punch a time clock than it is for the routine worker. The psychological effects of fatigue are insidious and treacherous. Enthusiasm for the war program and eagerness to do the job may keep an executive at his desk long hours and he may skip his weekly game of golf and his Sunday off. For a while that speeds the work. But after a while it becomes a little more difficult for him to make quick and sure decisions. Even more disastrous, against his will a sort of staleness may creep into his thinking. No longer is he eager to be at the job. No longer is he so sure of success.

British medical officers found that soldiers who have to make split-second judgments and keep up the fire of enthusiasm for their vital work must be forced to take rest periods—not just to avoid crack-up, but to stay in top-form vigorous spirit.

The announcement of policy of the U. S. Government officials emphasizes that the wise conservation of human resources and the protection of working efficiency and morale is equally vital on the home front.—Marjorie Van de Water.

THE PRONUNCIATION OF STAR AND CONSTELLATION NAMES

Years of confusion in pronouncing astronomical names may now come to an end. Often when referring to a star or constellation that he used in navigating his craft through the air or over the sea, the aviator or mariner has given the name such an unfamiliar twist that the astronomer has had to think twice to realize the object meant. Now, however, the American Astronomical Society has adopted officially a new list of pronunciations.

Prepared after consultation with teachers and others interested by a committee consisting of Dr. Samuel G. Barton, of the Flower Observatory of the University of Pennsylvania, *chairman;* George A. Davis, Jr., of the Buffalo Museum of Science, and Daniel J. McHugh, C.M., of De Paul University, Chicago, the complete list appears in *Popular Astronomy* for August. It includes the 88 constellations used by astronomers, fifty important special star names, the nine major planets, three clusters of stars and the letters of the Greek alphabet. The latter are often used by astronomers. Thus, the brightest star in the constellation of Orion is called alpha Orionis.

The special name for this star is "Betelgeuse," but it has had a variety of pronunciations, even in astronomical circles. One is *bet*-el-gerz, another beh-*tell*-gyou-eez and another "beetle-juice." The committee decided on *bet*-ul-jyuz. The first syllable is accented. The second syllable is pronounced like the el in "angel," and the u in the third syllable has the same sound as in "emulate."

The bright star Aldebaran in the constellation of Taurus the bull, which, like Orion, is seen to the south on winter evenings, is often called al-deh-*ba*-run by navigators. The last two syllables are pronounced the same as "baron." Dr. Barton's committee adopted al-*deb*-a run. The third syllable is pronounced like the a in "abound" and the last like the a in "sylvan."

For Cassiopeia, the W-shaped constellation seen in the northeast these August evenings, *kass*-ee-*ope*-ee-yuh has often been used, but they recommend *kass*-ih-oh-*pee*-yuh. The a in the first syllable is like that in "hat," the i in the second as in "bit," the o in the third as in "anatomy," the e in the fourth as in "be" and the a at the end as in "sofa." The first and fourth syllables are accented.

Planet names are also covered. Most of these are familiar, but Uranus has been subject to variation. Thus, you-*ran*-us is sometimes used. Now, it has been decided, this should be *u*-ra-nus. The a in the second

syllable is as in "abode" and the u in the last like that in "circus."—JAMES STOKLEY.

SPLIT HEVEA SEEDLINGS

MAKING two rubber trees grow where only one grew before, by splitting Hevea seedlings just after they have sprouted, is the newest step toward the solution of the natural rubber problem reported by scientists of the U. S. Department of Agriculture. The technique offers the possibility of doubling the yield from the limited, therefore doubly precious, supply of high-quality pedigreed seeds available for the establishment of rubber plantings in the Western Hemisphere tropics.

Hevea seedling-splitting was first developed by Dutch plant scientists, working on the great plantations of the Netherlands Indies. Their methods have been tried out, with variations that may produce improvements, by H. F. Loomis, of the Bureau of Plant Industry, at the U. S. Plant Introduction Garden at Coconut Grove, Florida.

Seedling-splitting in Hevea depends on the early growth habit of the plant. The rubber-tree seed looks like an oversize castor bean—Hevea is, as a matter of fact, a botanical relative of the castor bean. Only, when sprouting takes place, the thick seed-leaves or cotyledons are not pulled out of the seed-coat but remain in it, feeding the young plant for a time through the leaf-stems still attached to the shoot.

The first method of multiplying rubber plants by dividing them consisted simply of splitting the whole seedling into equal halves, from shoot-tip to roots, a few days after germination. The split halves of the shoot soon died, but new shoots came from a pair of tiny buds in the angles between the seed-leaf stems and the original shoot. This method, first described by a Dutch botanist named J. C. Zweede, was called the Ramaer method, after the botanist who invented it, R. Ramaer.

Later, an improvement was made on it by another botanist, but it was named not for a person but for a plantation, the Gambar Estate, near Malang, Java. In the Gambar method, the split is not into equal halves, but the cut is made into the side of the shoot, just above the junction with the seed-leaf stems. This leaves the original shoot to grow up, while a new one forms from the bud on the "short" side of the cut. This gives quicker growth to one side, because the original shoot does not die as it does in the Gambar method. The new shoot that forms on the other side grows just about as well as it does under the Gambar technique.

In both methods, the split seedling halves are still "siamesed" together by their attachment to the seed-leaves held firmly within the seed-coat. They grow side by side in flower-pots until they are big enough to separate and set out separately.

In an effort to eliminate this operation, Mr. Loomis tried carefully cracking the seed-coat and separating the seed-leaves at the time of the splitting. This eliminated the labor of later re-potting, but this saving was offset by the death of some of the seedlings.

Mr. Loomis also discovered that young seedlings growing in the open, with their tops killed by cold or eaten off by rabbits, could be split and replanted successfully after they had started new shoots from the side buds. Studies on this method, however, have been very few, and must be carried further before any recommendations as to possible practical application can be made.

SHARK LIVER OIL

SHARK fishing off the South Florida East Coast has been catapulted from a more or less despised calling to a vital defense industry. The reason is the urgent demand for shark liver oil, which is particularly rich in vitamins A and D. Shark liver oil is largely replacing Norwegian cod liver oil, now impossible to import.

Salerno, on Manatee Creek, up St. Lucie River, is the center of the revived and now flourishing shark industry. The sharks are caught on mile-long chain trot lines, baited with chunks of coarse fish every 25 feet, set on the edge of the Gulf Stream bottom and left overnight. The ends of the line are anchored and marked with buoys. Hauled to the surface the next morning by winches, the sharks are clubbed, brought to port and flayed. The livers are boiled for the oil, which is barrelled and shipped to Northern extracting plants. A shark's liver produces anywhere from two to 25 gallons of oil.

Varieties of the savage, cold-eyed scavengers of the sea, plentiful five miles off St. Lucie Inlet, include the nurse shark, hammerhead, tiger shark, leopard shark, lemon shark, mackerel shark and the great white shark. Sharks weighing up to and over 1,500 pounds, have been caught by the Salerno commercial fishermen. The average length is seven feet. The big fellows are the ones that got away, breaking the stout chain lines that held the three-quarter-ton "babies."

Sharks are processed as thoroughly as any pig in the Chicago stockyards. The skin is pickled in brine and goes to Newark, N. J., to be made into novelties and into a scuff-proof leather for the toe-caps of heavy working and hunting shoes. The fins find their way to the country's many Chinatowns for soup, and fetch a high price since the so-called delicacy can no longer be imported from Shanghai and Hong Kong; the flesh is chopped up for dog and poultry food and fertilizer; the jaws and teeth are sold for souvenirs; the backbones are made into walking sticks; and the eyes are dried, crystallized and polished as jewels for the novelty trade—now largely confined to men in khaki stationed in Florida.

Shark fishing is not without its dangers. Men have been caught on empty hooks, dragged overboard and drowned. Sudden tropical storms have sunk more than one shark boat. And now that German U-boats have commenced to machine-gun fishing boats the men of Salerno have another hazard to face.

But new boats nevertheless are being outfitted to go after the sharks. Shark liver oil is now as valuable and as sorely needed as rubber or tin.—J. HERBERT DUCKWORTH.

PREVENTABLE DISEASE OF ANIMALS

IF a farmer lets his animals die of a preventable disease, there's a certain anti-social stigma attaching to such neglect. A man may own his animals, but he's under implied obligation to deliver them or their products in

good condition for the use of our armed forces, our working forces on the home front, our allies on the world's far-flung battle lines.

That letting diseases or parasites do damage unchecked is giving license to a ceaselessly active mob of saboteurs that even in spite of our best efforts still do American livestock well over $400,000,000 worth of damage every year, is pointed out in the 1942 Yearbook of the U. S. Department of Agriculture which has now appeared.

Nor is the cash loss the only thing involved. Gove Hambidge, editor of the Yearbook, points out that diseased animals readily communicate some of their worst ills to human beings: anthrax, brucellosis, glanders, horse sleeping sickness, trichinae, tuberculosis, rabies and a whole medical chamber of horrors besides. Human beings in this country don't get foot-and-mouth infection because the eternal vigilance of the Bureau of Animal Industry has thus far stamped out every outbreak of this terrible plague of hoofed animals that has occurred within our borders.

The new Yearbook, titled "Keeping Livestock Healthy," is devoted entirely to problems of animal diseases and parasites. With a foreward under the slogan "Keep 'Em Healthy!" by Secretary of Agriculture Claude R. Wickard, the 1,238 pages are filled with 98 articles by eleven investigators headed by Dr. John R. Mohler, chief of the Bureau of Animal Industry.

Although the book takes up farm-animal diseases one by one, and animal by animal, it does not undertake to set up every farmer as his own veterinary. On the contrary, its aim is to enable the farmer to avoid need for calling the "vet" quite so often, especially since war needs have drawn off a large section of that none-too-numerous profession and the ones still available have to be "spread thin" and made to go as far as possible.

The 1942 Yearbook of Agriculture is the seventh, and regrettably the last, of a notable series edited by Gove Hambidge. Since the 1936 volume, each Yearbook has been devoted to one special subject: genetics, soils, food, climate, etc. Each has thus become a first-class reference book, unique in the agricultural literature of any language. The "economy" impulse of a Congress that cut off the Yearbook appropriation (while continuing to fatten the Congressional Record and frank it out by carloads) is much to be deplored.—Frank Thone.

ITEMS

The U. S. Department of Agriculture is trying to get stands of cork oaks, from whose bark cork is made, established in this country. But first, they have to learn where the trees will grow well. California is a known possibility, but there should be other places. It is requested that any one who knows of a really authentic cork oak, or a source of cork-oak acorns, to write in about it. Cork has become one of our severe wartime lacks. The only places where cork oaks grew in real numbers are the uplands of Spain, Portugal and North Africa.

Scientific information and documents are being sent back and forth across the Atlantic in the form of microfilm—miniature photographs that may be read by enlargement—in order to speed the mutual war effort of Britain and the United States. According to a statement made by Professor A. V. Hill, secretary of the Royal Society, the use of microfilm for scientific purposes began in the country in 1937 when literature in libraries was reproduced in this way for research workers. Regular scientific collaboration between American and British scientists has now been arranged with liaison officers in both capitals and other research centers. Experts are also ferried by air from one country to the other.

Quinine substitutes which will be official in the new U. S. Pharmacopoeia have been announced ahead of schedule, together with standards for their preparation because of the urgent need for protecting our overseas forces against malaria. Due to the present shortage of quinine, two synthetics, pamaquine naphthoate and quinacrine hydrochloride, may be of special value in keeping our armed forces free from the disabling periodic fever. Hearings are now under way in Congress on quinacrine patents which are alleged to restrict production. Totaquine, another anti-malarial, will also be in the new official book of drugs. This contains the familiar quinine but is mixed with several other related substances also found in the cinchona barks. It is expected that this mixture can be obtained from native cinchona barks found in Mexico and Central and South America instead of our former source in Japanese-held territory in the Far East.

Butter for troops in the tropics is practicable without the elaborate and costly refrigeration mechanisms that now make it such a problem. It can be "assembled" out of two milk constituents, butteroil and skim milk powder, has been demonstrated by Charles S. Trimble, of the Bureau of Dairy Industry, U. S. Department of Agriculture. Powdered skim milk and water are stirred into the butteroil, and the emulsion is poured slowly into cold water. Butter granules are formed, and may be worked into butter in the usual way. Butteroil is a clarified form of butterfat, which has been used in India for generations, under the name of "ghee." It also has some use in other dairy countries, notably Sweden and Switzerland. Butteroil can be kept from spoiling in hot climates by packing in airtight containers with all oxygen excluded. Dr. George E. Holm has developed a practical method for packing butteroil so that it will keep. At present, tin or other metal containers are used, but research is now under way to test the possible use of wooden kegs.

Additional evidence that diabetic patients treated with a daily dose of the protamine zinc form of insulin may continue to excrete sugar and still remain in good health, is reported in the *Journal* of the American Medical Association. Large doses of insulin administered in severe cases to prevent excessive amounts of sugar in the kidney excretion, often result in alarming illness due to reactions from the treatment. But after careful study, Dr. Edward Tolstoi and his associates suggest that the daily dose of protamine zinc insulin without too much regard for sugar level in the body fluids often results in loss of other diabetic symptoms, maintenance of weight and satisfactory control of the disease.

SCIENCE

Vol. 96 — Friday, August 28, 1942 — No. 2487

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 — Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

MOSQUITOES, MALARIA AND THE WAR IN THE PACIFIC[1]

By EDWARD PHILPOT MUMFORD

OXFORD UNIVERSITY AND STANFORD UNIVERSITY

The recent fall of Bataan was attributed mainly to malaria and lack of quinine by the United Press correspondent, Frank Hewlett, writing in *The New York Times* for April 18, and other observers. In the last war malaria took first place among the diseases responsible for casualties. Even in normal times, it is one of our most important public health problems. With the Dutch East Indies now largely in enemy hands, the principal source of supply of the world's quinine is lost to the United Nations, and although synthetic anti-malarials have been in use for some time, one can not overestimate the seriousness of a quinine shortage. Because of a low toxicity, and the fact that careful medical supervision is not required, quinine is still the most valuable drug for malarial prophylaxis and the treatment of acute malaria. There is no drug known to-day which can completely replace quinine and the other cinchona alkaloids. Because of these and other factors which are obvious, it is particularly important at this time to consider

[1] "Studies on Faunal Distribution," No. 7. These studies have received the support of the Carnegie Corporation of New York, the National Academy of Sciences, the American Association for the Advancement of Science, the Society of Sigma Xi, the American Philosophical Society, the May Esther Bedford Fund, Incorporated, and various subscribers to the Oxford University Chest. See G. D. Hale Carpenter, SCIENCE, 95: 325–326, 1942.

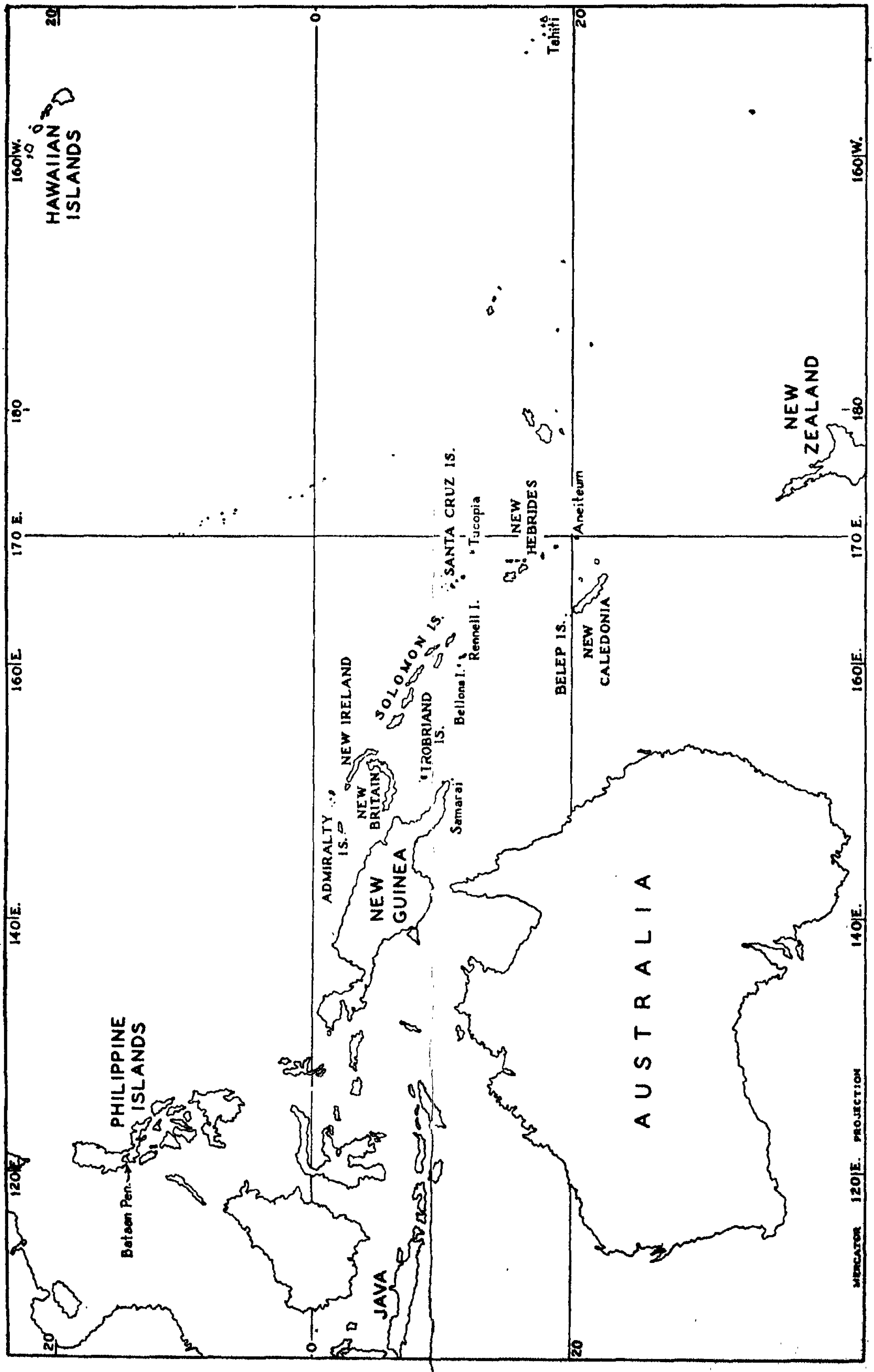
HAWAIIAN ISLANDS
PHILIPPINE ISLANDS
Bataan Pen.
JAVA
NEW GUINEA
ADMIRALTY IS.
NEW BRITAIN
NEW IRELAND
SOLOMON IS.
TROBRIAND IS.
Samarai
Bellona I.
Rennell I.
SANTA CRUZ IS.
Tucopia
NEW HEBRIDES
Aneiteum
Tahiti
BELEP IS.
NEW CALEDONIA
NEW ZEALAND
AUSTRALIA
MERCATOR PROJECTION
160 W.
180
170 E.
160 E.
140 E.
120 E.
20
0
20

FIG. 1.

the distribution of malaria and its carriers, the *Anopheles* mosquitoes, in the Pacific theater of the war.

According to P. A. Buxton, malaria is "believed to occur in all the islands between the equator and 20° S., from New Guinea eastwards to 170° E. The only islands inside this area which are free from malaria are Belep, to the northwest of New Caledonia, and a very few minute islands such as Tucopia. The only malarious island outside that area is Aneityum, which is a fraction of a degree further south than 20° S."[2] In his health surveys of 1930 and 1933, S. M. Lambert failed to find malaria in Rennell and Bellona Islands, but it has since reached Rennell (Lambert, *in lit.*, June 5, 1942), so Buxton's statement is now no doubt substantially correct. Authorities, however, do not agree as to the presence or absence of malaria and *Anopheles* in New Caledonia. M. A. Laveran, in *Comptes Rendus de la Société de Biologie* for 1901 and 1902, A. Leboeuf, in the *Bulletin de la Société de Pathologie Exotique* for 1913, and E. C. Zimmerman, in the *American Naturalist* for May–June, 1942, all specifically comment on the absence of *Anopheles* from New Caledonia. F. W. Edwards, in the "Genera Insectorum," 1932, and F. H. Taylor, in his "Check List of the Culicidae of the Australian Region," 1934, however, both include New Caledonia within the range of *A. punctulatus*. P. A. Buxton, in his review of Taylor's work in the *Tropical Diseases Bulletin* for 1935, does not accept this, and quotes Taylor as subsequently agreeing with him. Fritz Weyer, in "Die Malaria-Übertrager," 1939, however, again records *Anopheles* from New Caledonia. The question is of more than academic interest, as New Caledonia is a vitally strategic island along the supply route between the United States and Australia, and the United States has recently landed troops there.[3] If *Anopheles* are present there, the danger of infection is imminent and the troops will require daily prophylactic doses of such anti-malarials as are available; if they do not exist there, administration of drugs for malaria prophylaxis would be wasteful. In any case, a supply of quinine or a suitable synthetic substitute should be on hand, as *Anopheles* and malaria may be brought in from elsewhere.

The standard works of Edwards and of Taylor, mentioned above, to which the medical entomologist would naturally refer, are misleading in that they fail to give complete lists of the Pacific islands where *Anopheles* are definitely known to occur. Both Edwards and Taylor omit from the range of *Anopheles* the Admiralty and Trobriand Islands, New Britain, New Ireland, the Santa Cruz Islands and Samarai in the China Strait near New Guinea. Weyer omits the Admiralty, Trobriand and Santa Cruz Islands and Samarai. Kumm's paper in the *American Journal of Hygiene Monographic Series*, 1929, is more complete, but his record, now unacceptable, of a third species, the Australian *A. annulipes*, from the New Hebrides, was obtained by reducing *A. farauti* to a synonym of *A. annulipes* instead of *A. punctulatus*, as is now customary. Herms and Gray's record of *A. annulipes* from the New Hebrides, in "Mosquito Control," 1940, is no doubt derived from the same source.

As far as can be ascertained, there are at present in the Pacific Islands east of New Guinea two species and one variety of *Anopheles*. One of the species, *Anopheles punctulatus*, and its variety *molluccensis*, range into the Pacific as far east as the New Hebrides. Both are proven carriers of malaria. The other species, apparently as yet unnamed, is known only from the larvae taken in New Britain.

In view of the fact that an introduced *Anopheles*, carried from Africa by airplane or fast navy destroyer, was responsible for the wide-spread and devastating malaria outbreak in Brazil in 1931, it is important to consider the imminent danger of the spread of other members of the genus in the Pacific region. *Anopheles punctulatus* and its variety *molluccensis* have the most adaptable larvae of all known *Anopheles*, so they may be expected to extend their range beyond the New Hebrides and become established in new localities. According to Swellengrebel and Swellengrebel in the *Bulletin of Entomological Research* for 1920–21, *molluccensis*, wherever it occurs, is very common, breeding everywhere, in all kinds of water, fresh or salt, stagnant or running, dirty or clean. Larvae have been found even in water standing in coconut shells and in native boats. As early as 1928, fear of the introduction of *A. punctulatus* into Tahiti from the New Hebrides was expressed, and the danger of the spread of *Anopheles* through the Pacific islands is, of course, now increased immeasurably as a result of constantly increasing air traffic and disturbed conditions generally.

The islands of Mauritius, Reunion and Barbados long enjoyed immunity from *Anopheles* and malaria, but within the last century all three have suffered severe epidemics. It is not unlikely that New Caledonia, and even Hawaii and the islands of the Central Pacific, will lose their immunity before the end of the present war. As Herms and Gray write, the transport of a fertilized *Anopheles* to the Hawaiian Islands, where malaria is at present almost unknown, might

[2] *Trans. Roy. Soc. Trop. Med and Hyg.*, 19: 420–454, 1925–26. See also P. A. Buxton and G. H. E. Hopkins, "Researches in Polynesia and Melanesia," 3: 51–124, 1927.

[3] The recent outbreak of plague in New Caledonia is referred to elsewhere (E. P. Mumford, "Native Rats and the Plague in the Pacific," *American Scientist*, 30: 212–217, 1942).

ultimately become both a public health and an economic disaster to the Islands. With only a limited supply of quinine or other anti-malarials, the further spread of *Anopheles* and malaria might well affect an entire campaign and even the final outcome of the war in the Pacific.

The problem of mosquito control, which is of the utmost importance, is, of course, beyond the scope of this series of studies on faunal distribution. It has, moreover, been dealt with at length by leading authorities such as Herms and Gray.

As part of this series, revised lists of mosquitoes and other vectors of disease in the Pacific and other islands are being completed for publication in the hope that the dissemination of such information may be of use in the present emergency.

MECHANISM OF ACTION OF ORDINARY WAR GASES

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CURRENT interest in war gases justifies pharmacological discussion of their mechanism of action. This may help to give a rational background for advice to civilians for reasonably effective protection against, and management of, possible war gas injury.

In general, the intensity of biological action of any chemical is determined by (1) the dosage, in terms of mass of chemical per mass of living material; (2) the ratio of the rate of absorption and distribution of the drug through the living tissue to its rate of excretion or destruction; (3) the physico-chemical properties of the drug, such as its differential solubility in different solvents, its polarity, its molecular configuration and energy organization, its dissociation characteristics and its optical properties, and (4) the peculiarities of the particular type of living tissue involved, such as its age, its metabolic and allergic states and its enzyme balance. These factors may be summarized in short-hand fashion in the following non-mathematical formula:

$$I = (f)\left[D\frac{rA}{rE}\right],\ Ch,\ P.$$

The concentration (C) of the chemical in the tissues at any given moment after administration is given by the product of D and the ratio of rA to rE.

Consistent appreciation of these factors may aid both in understanding the difference in action of various war gases and also the variation in intensity of effect of the same war gas in the same concentration on different individuals. An appropriate analogy to the latter situation is the difference in response of different people to the same intensity of sunlight or poison ivy.

For this discussion we may limit ourselves to a consideration of the ordinary war gases, such as the lung irritants, like phosgene or chloropicrin, or the vesicants, like mustard gas and lewisite. We may thus disregard such unusual possibilities as catalyzed cyanides or metallic carbonyls, and such gaseous associates of demolition bombs and incendiaries as carbon-monoxide, "nitrous fumes," "blast," hot oil smoke or phosphorus. However, the tissue aggressiveness of "nitrous fumes" suggests that these deserve attention in the same way as ordinary war gases.[1]

As indicated in Table 1, the ordinary war gases may be considered to be chemical relatives of such types of aliphatic hypnotic and inhalation anesthetic agents as alcohol, chloroform and ether. There is general knowledge of the locally irritating powers of these common compounds. Their war gas relatives may owe an increased irritative action to aggressive factors associated with altered halogenation and polarity. These war gases usually contain a rather labile halogen, like chlorine or bromine, which, with the hydrocarbon portion, may be considered to be relatively lipo-proteophilic with respect to the rest of the molecule. On the other hand, the war gases also contain more potent polarizing radicles, like oxygen, sulfur, arsenic, a nitro group or oxime, which may be relatively hydrophilic or which may reduce the strength of the halogen bond. Differences in relative water-fat solubilities and in ease of hydrolysis may be important factors in the site of action or in the onset or duration of action, as exemplified in the contrast between lacrimators and vesicants.

TABLE 1

CHEMICAL RELATIONS BETWEEN COMMON IRRITANT DRUGS AND TYPICAL WAR GASES

Aliphatic irritant	Corresponding war gas
Alcohol $H{-}CH_2CH_2{-}OH$	Ethyl dichloroarsine $H{-}CH_2CH_2{-}AsCl_2$
Chloroform $Cl_3C{-}H$	Chloropicrin $Cl_3C{-}NO_2$
Ether $(H{-}CH_2CH_2)_2O$	Mustard gas $(Cl{-}CH_2CH_2)_2S$

One theory explaining the action of war gases is on

[1] Proceedings of a Board of the Chemical Warfare Service appointed for the purpose of investigating conditions incident to the disaster at the Cleveland Hospital Clinic, Cleveland, Ohio, on May 15, 1929. Edgewood Arsenal, Maryland, Lieutenant-Colonel Walter C. Baker, C.W.S., commanding. U. S. Government Printing Office, Washington, 1929, 104 pp.

the basis of splitting off halogen, with immediate irritant effect from the resulting halo-acid. This may occur promptly on the wet surfaces of eyes, and of mucous membranes of the nose, mouth, throat and lungs, with such agents as the lacrimators, phosgene and lewisite. On the other hand, as with mustard gas, the partition coefficient may favor absorption into the cells, after which the halogen may split off. The resulting halo-acid within the cell may alter enzyme systems, permeability of the surface membrane or protein equilibria, in such a way as to kill the cell. While such formation of acid may occur, it would have to exceed the buffering capacity of cells and tissues, and this might require relatively large amounts in order to pass the threshold. Neutralization by cellular buffers would be expected to produce the corresponding halide ion which would not markedly affect cellular function. At any rate, exhaustion of the buffer mechanism should reduce further hydrolysis. Direct experiment has shown that molecularly intact mustard gas may be isolated from deep skin layers many hours after absorption. Again, acid injury usually involves protein denaturation and precipitation, whereas war gas injury is characterized more by disturbances of cellular permeability, with swelling, protein hydrolysis and cellular disintegration.[2]

Another type of mechanism of action may operate. This relates to the relatively rigid molecular configuration of the war gas molecule as compared to the cell membrane. The latter is interpreted as a water-lipoprotein interface.[3] Portions of the war gas molecule seem to be relatively lipo-proteophilic, while other portions seem to be more hydrophilic. If enough war gas molecules are present at the cell surface, distortion of the interface may occur. This would result from orientation of the war gas molecule in accordance with the selective affinity of different parts of the molecule for water and lipo-protein, respectively. If this affinity and the interatomic angle forces in the war gas molecules are greater than the surface tension forces which maintain the normal cell surface, torsion may follow, with changes in permeability of the surface film, with resulting swelling and further distortion and strain of the surface membrane. This may comprise the initial inflammatory response to war gases, which may go on to cellular rupture, vascular breakdown, autolysis and necrosis, as so well described by Livingston and Walker.[2] Tight packing of cells, as may be accomplished by high ascorbic acid intake,[4] would tend to reduce the intensity of this reaction, as Livingston and Walker noted.[2]

Whichever mechanism occurs, the prolonged tissue response to war gases would subsequently include the slow removal of necrotic debris, to be followed by gradual repair. In the case of lung irritants, this sluggish process indicates the need for protracted oxygen administration as well as for prophylaxis against psychiatric pneumophobia.

In the biological effects of war gases, therefore, it seems that one or more of the following factors are concerned: (1) relative water, fat and protein solubility, both in transport and in relation to cell surface; (2) relative ease of hydrolysis, with relation to possible formation of halogen acid and the effects of the rest of the molecule; (3) distortion of cellular surfaces due to the molecular configuration of war gas molecules or to their secondary valence forces, and (4) effects of war gas molecules on pH, redox potential and colloid, interface and enzyme equilibria.

As in the case of sunburn or exposure to poison ivy, once the process of war gas injury is under way, one may hope for benefit only on the basis of symptomatic relief, of aiding the removal of necrotic tissue and of promoting repair. It would seem wise, therefore, to train civilians in "self-aid" in suspected contact with war gas, since first-aid or professional care is apt to be too late.

In order to reduce confusion of thought to a minimum and thus to help prevent panic in suspected attack with war gas, "self-aid" should be devised in as simple a manner as possible. Recommendations should be based on the least common denominator of effectiveness for whatever is likely to be used by a smart enemy. Since mixtures of war gases are certain to be employed, it seems unwise to worry about specific identification and specific management of potential injury, if such identification is based on such an indefinite procedure as smell.

Absorption of the ordinary war gases and their many obvious chemical relatives may be inhibited by neutralizing hydrolysis, oxidation or adsorption. For civilian use, these methods may be improvised from materials readily available in homes. Since the war gases in general are decomposed or poorly soluble in water, a wet cloth tied over the nose and mouth is a relatively effective barrier to the passage of such vapors, including oil smoke and "nitrous fumes," to the nose, throat and lungs.

The most readily available effective oxidants are the common kitchen bleach solutions, such as "Clorox." These are buffered 3 to 5 per cent. sodium hypochlorite solutions and are non-irritating for blotting the

[2] P. C. Livingston and H. M. Walker, *British Jour. Ophthal.*, 24: 76, 1940.

[3] J. F. Danielli and H. Davson, *Jour. Cell. Comp. Physiol.*, 5: 495, 1934; J. F. Danielli, *Proc. Roy. Soc.*, B, 121: 605, 1937; A. J. Clark, General Pharmacology, Handb. Exper. Pharmakol., Erganzungswerk, 4: 14, 1937.

[4] S. B. Wohlbach, *Amer. Jour. Path.*, 9: 689, 1933; J. F. Rinehart, L. D. Greenberg, M. B. Olney and F. Choy, *Arch. Intern. Med.*, 61: 552, 1938.

skin, but should be diluted for application to mucous membranes, for washing the skin or for wetting cloths to breathe through. As is well known, such a solution reacts promptly with mustard gas, 2,2′-dichlorodiethyl sulfide (BP 217° C.), converting it quantitatively to the non-toxic crystalline 2,2′-dichlorodiethyl sulfoxide (MP 110° C.). The use of such sodium hypochlorite solutions for the prevention of mustard gas injury has been widely advertised in England.[5] Confirmation of their effectiveness against both mustard gas and lewisite has been obtained by Professor T. D. Stewart, of the University of California, Berkeley, on scores of human subjects, and by ourselves on humans and experimental animals. It is immaterial whether oxidation of mustard gas produces the sulfoxide or sulfone, or further decomposition, or what is produced on treating lewisite with hypochlorite. Direct experiment shows that such treatment of these compounds or their obvious chemical relatives results in non-toxic residues.

For alkaline hydrolysis, sodium bicarbonate solutions around 2 per cent. may be readily prepared in a black-out room by dissolving a teaspoonful of baking soda in a glass of water. Such a solution is helpful in washing out the eyes, nose and throat in suspected war gas irritation, or for wetting cloths to breathe through.

The most suitable and readily available detergent adsorbent is lather from ordinary soap and water or soap flakes or tincture of green soap. This is particularly useful, as are hypochlorite solutions, in preventing skin injury from suspected contact with blister gases. The data in Table 2 show the value of soap and hypochlorite in reducing skin injury (in a rather sensitive test object) from mustard gas application, in comparison with such a mustard gas solvent as kerosene.

The common blister gases are soluble in kerosene, gasoline, acetone, carbon tetrachloride and similar fat solvents. During World War I, it was naturally assumed that such solvents would be useful in removing liquid blister gas splashes from the skin. We have found no data to support this idea. However, current advice to civilians retains this recommendation. It is to be remembered that kerosene, gasoline and acetone may be absorbed through the skin, and that, like carbon tetrachloride, they are themselves skin irritants. They are also solvents of low viscosity and tend to spread easily. It is unlikely that they would be used carefully under the conditions of excitement existing in the crisis of suspected war gas contact. Our experiments show (Table 2) that even under controlled conditions they are much less satisfactory than lather or hypochlorite.[6]

Pharmacologists have the obligation of establishing and explaining the facts regarding the action of chemicals on living things. They have the privilege of applying such information to whatever practical problem may be appropriate. With respect to war gases, present pharmacological information suggests that the simplest and most effective advice for civilian protection against such gases might be: (1) obey air-raid rules, taking refuge during an alarm in an air-raid shelter or black-out room, with doors and windows shut and the windows screened or heavily curtained on the inside to prevent injury from flying glass, if bombing occurs; (2) if the shelter is broken open by bombing, and if war gases are suspected by fogs, peculiar odors, smarting or stinging in the eyes, nose or throat, or by coughing, sneezing or gasping, or by any other suspicions, tie a cloth soaked in baking-soda solution, or diluted kitchen bleach solution, over the nose and mouth to breathe through,

TABLE 2

AVERAGE CHARACTER OF SKIN RESPONSE IN RABBITS TO 0.05 CC 10 PER CENT. MUSTARD GAS (HS) IN ETHER, WITH TREATMENT CONSISTING OF THRICE BLOTTING AREA OF APPLICATION (ROUGH CIRCLE 10 MM IN DIAMETER) ONE MINUTE AFTER APPLYING HS WITH GAUZE SOAKED IN KEROSENE, SOAP AND WATER, OR 3 PER CENT. NaOCl (CLOROX), RESPECTIVELY*

Day	Untreated	Kerosene	Soap	3 Per Cent. NaOCl
1	Intense erythema and edema	Moderate erythema, slight edema	Diffuse erythema, slight edema	Diffuse erythema
2	Diffuse erythema and edema, central blanched area	Diffuse erythema and edema, central blanched area	Blanched area, 10 × 15 mm	Blanched area, 10 × 15 mm
5	Deep hemorrhagic necrotic area, 10 × 12 mm	Hemorrhagic necrotic area, 12 × 15 mm, with diffuse necrosis at edges	Thin scaley necrosis, 8 × 10 mm	Thin scaley necrosis, 8 × 10 mm
15	Heavy adherent scab, 10 × 12 mm	Broad adherent scab, 15 × 20 mm	Thin flakey scab, 8 × 10 mm	Thin flakey scab, 8 × 10 mm
22	Heavy adherent scab, 10 × 12 mm	Broad adherent scab, 15 × 20 mm	Light scar	Light scar

* No significant difference from untreated areas observed after application (as above) of either 3 per cent. H_2O_2, acetone or "bleach paste." Treatment with 5 per cent. NaOH in 30 per cent. glycerine seems to increase inflammatory reaction during first week, producing a deeper and slower healing necrotic area. Ten per cent. benzoyl peroxide in nona ethylene glycol seems to have little effect on HS reaction during first day or so, but seems to reduce necrotic reaction and time required for healing. However, 10 per cent. benzoyl peroxide in talc affords no protection when dusted on skin previous to exposure. Observations similar to the above have been obtained with lewisite; healing, however, is more rapid.

[5] Half-page advertisement *British Med. Jour.*, opposite page 445, April 4, 1942.

[6] D. F. Marsh and C. D. Leake, *Calif. West. Med.*, 57: 8, 1942. Acknowledged in spite of printer's many typographical errors!

keep it wet, shut one eye and squint through the other, and lie down with head in arms; (3) if eyes, nose or throat are irritated, wash them with a solution of a teaspoonful of baking soda in a glass of water; (4) if splashes of liquid are suspected on the skin or clothes, throw the outer clothing out the window, blot the skin splash promptly and repeatedly with a cloth wet with kitchen bleach solution, lather thoroughly and frequently with soap and rinse copiously with water. If subsequent injury results, the management is symptomatic at a casualty station or hospital.

These considerations were fully reviewed early in 1942 by the San Francisco and Alameda Committees on the Medical Aspects of War Gases. Special discussions along these lines have been widely published on the West Coast for civilian information.[7] Experience has shown that these suggestions for "self-aid" in handling suspected war gas exposure are appreciatively received by the public because they are simple and sensible. Recently these suggestions in substance have been included in "official" recommendations.[8]

OBITUARY

JACOB GOULD SCHURMAN

1854–1942

The death of Jacob Gould Schurman at the ripe age of eighty-eight years will remind present-day scientists of the versatility of their colleagues in an earlier generation. Dr. Schurman was trained as a philosopher in a day when to be such was to qualify both as a metaphysician and moralist and also as a mental scientist. When, in 1903, the first selection of distinguished men was made from those listed in the first edition of "American Men of Science," Dr. Schurman's name received a "star" among the fifty leading psychologists of that time. He had already served eleven years as president of Cornell University, but was still rated by his colleagues as an active scientist and member of the American Psychological Association.

Dr. Schurman's long career was marked with distinction as a scholar and teacher, as a university administrator and as a diplomat. As dean of the Susan Linn Sage School of Philosophy, which was established at Cornell by a trustee, Henry W. Sage, in memory of his wife, Dr. Schurman saw to it that one of the chairs in this school should be devoted to the new science of psychology. The first incumbents, Frank Angell, followed after one year by Edward Bradford Titchener, were brought to Cornell by President Schurman from the psychological laboratory of Wilhelm Wundt in Leipzig. Thus, from the beginning of the school, experimental research in psychology was fostered and developed by its dean and president.

Academic men of science also owe a debt of gratitude to this president of Cornell for his promotion of faculty participation in university administration. It was under Dr. Schurman's régime that faculty representatives were first elected to the board of trustees of Cornell University, and it was likewise with his support that the faculty of the College of Arts and Sciences was granted opportunity to elect its own dean. In all matters of university policy Dr. Schurman was well in advance of his time. If the elective deanship failed to perpetuate itself at Cornell, it was for lack of faculty enterprise and not for lack of support by the president.

The foundation and endowment of the Cornell Medical College owe much to Dr. Schurman, and the advancement of experimental science at Cornell was always of first importance to him. It was under his leadership that the university acquired three of its outstanding laboratories: Stimson Hall for the promotion of the medical sciences; Rockefeller Hall for the promotion of physics, and the well-planned and equipped Baker Laboratory of Chemistry.

After thirty-four years at Cornell, including twenty-eight as president of the university, Dr. Schurman retired to carry on a political and diplomatic career already initiated by his appointment in 1899 as president of the first United States Philippine Commission. Yet his interest in academic matters never lapsed. He was the leading spirit in raising an endowment of one-half million dollars for the University of Heidelberg—a university in which Dr. Schurman himself, like many other American scholars, had received training. He also lectured frequently before academic audiences, including appointments in 1931 and 1932 as honorary lecturer on international relations at the Institute of Technology in Pasadena, California.

Men of his breadth of view and depth of knowledge are rare to-day. To be a great educational leader and at the same time to be recognized as a participating member of several cognate fields of learning, is a distinction which can no longer be claimed by a specialist. Yet it is to men like Dr. Schurman that we owe the foundations and endowments which have made modern scientific progress possible, and our debt to them is greater than we are likely to remember.

R. M. Ogden

Cornell University

[7] Articles on war gases by J. F. Hildebrand (*The Commonwealth*, 1942; *San Francisco Chronicle*, Feb. 15, 1942), M. Silverman, *San Francisco Chronicle*, March 15, 22, 29, Apr. 5, 1942) and W. F. Mould, leading West Coast newspapers through June and July, 1942.

[8] *Jour. Am. Med. Assn.*, 119: 889, July 11, 1942.

DEATHS AND MEMORIALS

Albert W. Smith, professor of mechanical engineering at Stanford University from 1892 to 1904; later successively director of Sibley College of Engineering of Cornell University and dean of the college, died on August 16 in his eighty-sixth year.

Dr. Louis Roule, professor of science at Toulouse University from 1885 to 1910, later professor at the Paris Museum of Natural History, died on August 4 at the age of eighty-one years.

The astronomical observatory of Vanderbilt University, founded over sixty years ago, will hereafter be known officially as "Barnard Observatory of Vanderbilt University" in honor of the late Edward Emerson Barnard, the distinguished astronomer who was an alumnus of the university.

SCIENTIFIC EVENTS

THE NATIONAL PARKS ASSOCIATION

The following resolutions were adopted at the annual meeting on May 15 of the trustees of the National Parks Association:

Commercial Encroachments

Since the National Parks and Monuments comprise a valuable part of the heritage which we are now fighting to maintain, and

Since pressure was exerted during the first world war for such destructive and depleting uses as grazing, timber cutting and power development in the National Parks, and

Since increasing pressure for similar encroachment is being brought upon the National Park Service in the present war, be it therefore

Resolved, That the National Parks and Monuments should not be opened to any commercial use until there is definite proof of its necessity, and until all other possible sources of the needed materials have been explored, and be it further

Resolved, That the National Parks Association will examine each threat of commercial encroachment upon the National Parks and Monuments to determine whether it is inimical to the public interest.

The Quartering of Enemy Aliens in National Parks

Since the proposed quartering of enemy aliens within the National Parks and Monuments would jeopardize the natural conditions, particularly in forested areas, which are subject to destruction by fire, and

Since such quartering of enemy aliens would certainly interfere with normal use by visitors seeking rest and inspiration therein, be it therefore

Resolved, That enemy aliens should be quartered in areas other than the National Parks and Monuments and where they will not endanger the war effort.

Military Use of National Parks and Monuments

Since the National Primeval Parks and National Monuments were established as outstanding natural areas worthy of complete preservation for the benefit and enjoyment of the people, and

Since extensive military training and maneuvers are incompatible with such use of these areas, and irreparable damage to their natural features must result therefrom, and

Since less restricted and equally suitable areas on other public lands are available for military purposes, be it

Resolved, That only in case of proven necessity, and after every other possible area has been investigated and shown to be unsuitable for the proposed use, and only in accordance with the recommendation of the National Park Service and the Department of the Interior, should National Primeval Parks and National Monuments be used for military purposes.

The Virgin Forest of the Porcupine Mountains

Since the virgin forest of the Porcupine Mountains on Michigan's upper peninsula constitutes the finest remaining example of the original forests in the Great Lakes region, and

Since there is imminent danger of these mountains being desecrated through reckless and wasteful lumbering or development for extensive tourist use with the resultant loss of their value as a superlative natural area, be it therefore

Resolved, That the Porcupine Mountains should be acquired by the Federal Government for preservation in their present primitive condition.

Sabotage Forest Fire Control

Since the probabilities of subversive action in setting forest fires present a serious danger to the nation's heritage of superlative natural areas, and to the prosecution of the war, be it therefore

Resolved, That advance provision of adequate funds should be made for the purpose of preventing and combating such forest fires.

THE PENNSYLVANIA STATE FORESTS

Dr. Gifford Pinchot, formerly Pennsylvania State Commissioner of Forestry and forester of the Department of Agriculture; Governor of Pennsylvania from 1923 to 1927 and from 1931 to 1935, has made public the following statement:

In a letter to Harrisburg I said that I had recently seen portions of the state forests of Pennsylvania butchered by lumbermen, and urged that it be stopped.

Harrisburg refused to stop it, and quoted in defense two men without professional training or practical experience in forestry. One of them set up our war needs in excuse. That excuse is worthless.

If the war needed every last tree in Pennsylvania, we should give it, of course. But the war does not need it.

The chief forester of the United States Forest Service

says this: "I am convinced that in winning the war it is wholly unnecessary, and in addition the worst possible public and industrial policy, to destroy or depreciate the future productivity of our forests. We can cut all the timber we need to meet every conceivable war requirement and still cut in such a way that the productivity of the forest will be increased rather than impaired."

The productivity of our state forests is being impaired. Within the last two years the most destructive cutting of them ever perpetrated has been and is still going on.

This cutting, which Harrisburg defends, is not limited to trees selected and marked, as good forestry requires, but all trees above certain sizes have been sold and cut, without discrimination.

Trees too young for cutting, trees needed for seed, or to maintain the forest cover, help control floods, prevent erosion or otherwise necessary, have been cut regardless.

The second Harrisburg witness without professional training or practical experience alleged that this is good forestry. I say it is not forestry at all, but forest butchery. For the safety and welfare of Pennsylvania, it ought to be stopped. Will you help stop it?

THE BEACH PLUM PRIZES OF THE ARNOLD ARBORETUM

Dr. James R. Jewett, of Cambridge, Mass., emeritus professor of Arabic, Harvard University, in 1940 presented the Arnold Arboretum with a capital sum under the conditions that from its income two annual prizes might be awarded to individuals who have made significant contributions to the improvement of the native beach plum, or who, through the development of beach-plum products, may have made contributions of social significance. The first awards were made in 1941.

The James R. Jewett Prize of $100 for 1942 has been awarded to J. Milton Batchelor, of the U. S. Soil Conservation Service, for his outstanding work with the native beach plum. The Vieno T. Johnson Prize of $50 has been awarded to William Foster, of East Sandwich, Mass.

The committee of selection was made up of staff members of the Arnold Arboretum, the Massachusetts State College and a representative of the Cape Cod beach plum growers. The recognition of the work of a professionally trained plant hunter and a Cape Cod grower as the recipients of the two prizes for 1942 is illustrative of the cooperative spirit now existing in the efforts being made to locate and to propagate the better types of beach plums. At the present time there is much new interest in the beach plum and its products, some of which is directly traceable to an appropriation made last year by the Massachusetts Legislature, providing special funds to the Massachusetts State College for research on beach-plum problems. This bill was the direct result of the continued efforts of Mrs. Wilfred O. White, of Martha's Vineyard, who was the recipient of the James R. Jewett Prize for 1941. Experimental work is now being prosecuted by staff members of the Massachusetts State College, which should eventually solve many problems in reference to selection, propagation, fertilizing, pruning and spraying of the beach plum.

J. Milton Batchelor, the recipient of the James R. Jewett Prize for 1942, was graduated from Cornell University in 1933. For some years he has been a member of the Soil Conservation Service, his particular duties being to find variations in native fruits which might prove to be of economic value, to study their adaptability for use in soil erosion projects and to ascertain their possibilities as ornamentals. His work has involved very extensive travel. On trips to eastern Massachusetts during the past few years he became particularly interested in the beach plum, and has located, propagated and distributed a number of varieties with larger and better fruits. He has freely advised many individuals in Massachusetts who were interested in the beach plum and has vigorously supported the campaign to increase interest in this field.

William Foster, of East Sandwich, Mass., recipient of the Vieno T. Johnson Prize, has for many years been interested in growing beach plums on Cape Cod, and has recently been prominently identified with some of the experimental work now being carried out by members of the horticultural staff of the Massachusetts State College.

THE UNIVERSITY OF MICHIGAN

At his own request, William Gabb Smeaton, professor of chemistry at the University of Michigan, who is now sixty-eight years old, will be retired on September 8. He has been named professor emeritus of chemistry. He served as a member of the faculty of the University of Michigan College of Literature, Science and the Arts for a period of forty years. The following resolution has been adopted by the Board of Regents: "Professor Smeaton has ably and loyally contributed to the successful accomplishment of the university's work through the skilful conduct of instruction, through the preparation of valuable manuals for the use of teachers and students of chemistry and the history of science, and through his participation in the scholarly activities of the institution, and thereby gained for himself the esteem and affection of his colleagues and students which is amply due him as a man of admirable character and recognized ability. . . ."

Walter Bowers Pillsbury, professor of psychology, will retire at the age of seventy years on September 26. He has been named professor emeritus of psychology. He joined the faculty of the university in 1897 and has been associated with the College of Literature, Science and the Arts continuously for forty-five years. The Board of Regents cited Pro-

fessor Pillsbury for the large part he played in the development of the university's department of psychology and for his "noteworthy research, teaching and writing . . . his eminence as a scholar . . . and the genuine affection of students and colleagues inspired by his wholesome character and unassuming friendliness."

Action taken at a recent meeting of the Board of Regents included:

Appointments: Professor Arnold M. Keuthe was appointed acting chairman of the department of aeronautical engineering to take the place of Professor Edward A. Straiker, resigned.

Leaves of absence to staff members called to active military service: John C. Brier, professor of chemical engineering, university year, 1942–43, to serve as lieutenant colonel in the U. S. Army in charge of the Training School at the Ravenna Ordnance Plant at Ravenna, Ohio.

Drs. John M. Sheldon, Edgar A. Kahn, Walter G. Maddock, S. Milton Goldhamer, Moses M. Fröhlich, George Hammond, Harry A. Towsley, Marshall L. Snyder and E. Thurston Thieme, all serving with the U. S. Army Medical Corps in the 298th General Hospital Affiliated Unit.

Dr. Alexander Barry, instructor in anatomy, university year, 1942–43, commissioned in the Air Corps of the U. S. Army.

Dr. Richard C. Armstrong, resident in the department of ophthalmology, university year, 1942–43, commissioned in the U. S. Army Medical Corps.

Dr. Hayden C. Nicholson, associated professor of physiology, university year, 1942–43, commissioned as a captain in the U. S. Army Medical Corps.

Dr. G. Howard Gowen, professorial lecturer in epidemiology, July 9, 1942, to June 30, 1943, called to active duty in U. S. Army.

Steve Remias, instructor in epidemiology, July 15, 1942, to June 30, 1943, called to active duty in the U. S. Navy.

Dr. Herman H. Goldstine, instructor in mathematics, July 18, 1942, to June 30, 1943, for service as a First Lieutenant in the U. S. Army Air Forces.

Professor Harley Bartlett, chairman of the department of botany, university year, 1942–43, to carry on investigations for the U. S. Department of Agriculture.

Dr. James M. Cork, professor of physics, summer of 1942, to take part in the research program at the California Institute of Technology of adapting the cyclotron to war purposes.

Dr. L. H. Newburgh, professor of clinical investigations in the department of internal medicine, June 1, 1942, to December 1, 1942, to become a member of a subcommittee on clinical investigations for the Division of Medical Sciences of the National Research Council and to devote his entire time to medical problems arising out of the war.

Dr. Robert C. F. Bartels, instructor in mathematics, June 15, 1942, to June 14, 1943, to serve as a consulting mathematician in the Bureau of Navigation, U. S. Navy.

H. S. Bull, assistant professor of electrical engineering, university year, 1942–43, to engage in research for the U. S. Army Signal Corps.

Edwin M. Baker, professor of chemical engineering, summer term, to devote full time to work for the Houdaille-Hershey Corporation and other companies on the manufacture of armaments.

Dr. Clarence A. Siebert, associated professor of metallurgical engineering, summer term, to carry on work with the Houdaille-Hershey Corporation related to the war program.

Lewis N. Holland, assistant professor of electrical engineering, summer term, to term defense courses.

Arthur J. Decker, professor of civil engineering, summer term of 1942.

William S. Housel, associate professor of civil engineering, summer term of 1942.

Extensions of Leave: The leave of absence of Professor Ralph A. Sawyer, of the department of physics, has been extended for the university year 1942–43. Professor Sawyer is a lieutenant commander in the U. S. Navy in charge of the testing laboratory at the Naval Proving Grounds at Dahlgren, Va.

SCIENTIFIC NOTES AND NEWS

THE Royal Society of Canada has awarded the Flavelle Medal "for original research of special and conspicuous merit" to Dr. J. H. Craigie, head of the Dominion Rust Research Laboratory at Winnipeg, Man., in recognition of his work on the control of wheat rust.

AT the annual meeting of the Woods Hole Marine Biological Laboratory on August 11, Lawrason Riggs was elected president of the corporation and chairman of the board of trustees to succeed Dr. Frank R. Lillie, who was made president emeritus. The newly created position of vice-president was filled by the election of Dr. E. Newton Harvey, professor of physiology at Princeton University.

AT the annual meeting of the trustees of the Oceanographic Institution, Woods Hole, Dr. Alfred C. Redfield, professor of physiology at Harvard University, was elected associate director.

A PORTRAIT of Dr. John Bentley Squier, professor emeritus of urology of Columbia University College of Physicians and Surgeons, was unveiled on July 1 at the Squier Urological Clinic of the Presbyterian Hospital. The portrait, the work of Julian Lamar, is a bequest of the late Adolph S. Ochs, publisher of *The New York Times* from 1896 to 1935.

DR. ARTHUR J. HILL, chairman of the department of chemistry and director of the Sterling Laboratory of Yale University, has been appointed to the new Whitehead professorship in chemistry. The Whitehead professorship was named in honor of the late

Conkey P. Whitehead, of the class of 1919, who died in 1940, leaving a bequest to the university for the support of work in chemistry.

Dr. Baldwin M. Woods, professor of mechanical engineering at the University of California, Berkeley, has been named director of university extension. Boyd B. Rakestraw, assistant director, who has been in charge of extension activities since the retirement of Professor Leon J. Richardson four years ago, has become associate director.

Dr. Catharine Macfarlane, professor of gynecology, has been made research professor of gynecology at the Woman's Medical College of Pennsylvania in recognition of her work in cancer research.

Dr. A. Castiglioni, formerly professor of the history of medicine at Padua, is giving a series of weekly lectures on medical history at the Yale University School of Medicine.

Sir Henry Tizard, since 1929 rector of the Imperial College of Science and Technology, London, known for his researches in aeronautics, has been elected president of Magdalen College, Oxford. *Nature* points out that this is a timely and important break with Oxford tradition, for he is the first man of science to become the head of a college there. Sir Henry is now a member of the British Air Council and of the Advisory Council of the Ministry of Aircraft Production.

Dr. Myron E. Wegman has been appointed director of training and research in the Bureau of Child Hygiene, New York City. A training unit has been established at the Kips Bay-Yorkville Health Center, 411 East Sixty-ninth Street, which, under his direction, will train new physicians employed by the bureau to replace staff members called into military service.

A. E. White, director of the department of engineering research and professor of metallurgical engineering at the University of Michigan, has been nominated as manager of the American Society of Mechanical Engineers for 1943.

F. C. Todd, of the Pennsylvania State College, has joined the technical staff of Battelle Memorial Institute, Columbus, Ohio. He will undertake research work in industrial physics.

Dr. Leonard N. Allison, fish pathologist and district fisheries biologist of the Institute for Fisheries Research of the Michigan Department of Conservation, has joined the staff of the State Fish Hatchery, Grayling, Mich.

Dr. Paul Herget, assistant professor of astronomy at the University of Cincinnati and astronomer at the Cincinnati Observatory, has leave of absence for the duration of the war to accept a war emergency appointment to the Nautical Almanac Office of the U. S. Naval Observatory, Washington.

Dr. Frank L. Campbell, professor of entomology at the Ohio State University, has leave of absence to perform advisory service on insecticides in the Chemicals Division of the Office for Agricultural War Relations of the U. S. Department of Agriculture.

Oliver Bowles has been named chief of the Nonmetal Economics Division of the U. S. Bureau of Mines, succeeding Paul M. Tyler, who has become a member of the Board of Economic Warfare.

Sir Guy Marshall, who has been director of the British Imperial Institute of Entomology since its foundation in 1911, retired on July 31. Dr. S. A. Neave has succeeded him.

The appointment of a committee of chemists and chemical engineers to advise the Government on technical processes is announced by Ernest W. Reid, chief of the Chemicals Branch of the War Production Board. The committee will pass upon the relative merits of competing chemical processes involved in the war effort. The basis upon which the findings will be made is (a) which process can be placed in production soonest and (b) which uses the smallest amount of critical materials. Donald B. Keyes, head consultant to the branch and professor of chemical engineering at the University of Illinois, is chairman of the committee. The members are Marston T. Bogert, Joel H. Hildebrand, S. C. Lind, Frank C. Whitmore, Gustavus J. Esselen, Carl S. Miner, Foster D. Snell, Charles C. Brown, Charles R. Downs, Sidney D. Kirkpatrick and Fred H. Rhodes.

A committee has been formed in the British House of Commons to consider the question of synthetic rubber to be constituted as follows: F. W. Bain, chairman of the Chemical Control Board of the Ministry of Supply, *chairman;* Sir Edward V. Appleton, secretary of the Department of Scientific and Industrial Research; Dr. J. W. Armit, director-general of explosives at the Ministry of Supply; Sir Robert Robinson, Waynflete professor of chemistry at the University of Oxford; and Dr. F. Roffey, controller of chemical research at the Ministry of Supply.

The British Government was on July 16 requested by an influential deputation, composed of scientific men, members of Parliament and peers, which was arranged by the War Cabinet Scientific Advisory Committee, to set up a full-time scientific and technical joint board. This would have as its aim the fullest strategic use of scientific man-power and resources and the proper organization and exchange of scientific and technical information relating to the

war effort. Members of the deputation included Lord Samuel, Captain Leonard Plugge, M.P. (chairman of the Parliamentary and Scientific Committee, from whom the deputation came), Dr. W. Wooldridge, C. S. Garland (British Association of Chemists), Professor W. Makower (Institute of Physics), Sir Lawrence Bragg, Professor B. W. Holman, Gower Pimm (Institute of Structural Engineers), Professor Bernal (Association of Scientific Workers), Colonel Thompson (president of the Institution of Mechanical Engineers), J. H. Wootton-Davies, M.P., Lord Pentland, Hugh Linstead, M.P., R. B. Pilcher (Institute of Chemistry), Lord Leverhulme and Lord Hinchingbrooke. It is reported that one of the points emphasized by some members of the deputation was that young scientific men of ability should be given more encouragement to exercise their inventive faculties. The view was expressed that not only the War Cabinet but the Chief of Staffs Committee should be advised by scientific men on appropriate matters.

It is reported in *Nature* that at a recent meeting of the trustees of the Beit Memorial Fellowships for Medical Research, Dr. A. N. Drury, Huddersfield lecturer in special pathology in the University of Cambridge, was appointed to the advisory board in succession to the late Professor A. J. Clark. The trustees noted the election this year of three past fellows to the fellowship of the Royal Society, namely, E. Hindle (junior fellow, 1910–12, and senior in tropical medicine, 1927–33), F. M. Burnet (1926–27) and A. R. Todd (1935–36). Of the twenty-eight present fellows, there are now fourteen seconded for whole-time war-work. The following elections have been made, with permission for each fellow to be seconded at any time for war duties: *4th Year Fellowship* (£500 a year), E. G. L. Bywaters, to continue his studies of crush injuries in relation to kidney function, at the British Postgraduate Medical School, London. *Junior Fellowships* (£400 a year), Dr. D. Herbert, to study the biochemistry of toxoids for active immunization against gas gangrene, at the Dunn Biochemical Laboratory, University of Cambridge. Dr. F. W. Landgrebe, to study the separation of posterior pituitary hormones and their clinical uses, at the Medical School, University of Aberdeen.

The seventeenth Congress of the French Medical Association of North America will be held at the Hôtel Mont-Royal, Montreal, from September 14 to 17.

The London correspondent of the *Journal* of the American Medical Association states that the report on the work of London University during the past year shows that in spite of financial and other difficulties due to the war it remains a valuable institution which is producing skilled men and women both for war work and for playing a useful part in reconstruction after victory. In 1938–1939 there were 14,587 internal and 10,893 external students. In 1940–1941 (the first complete war year) the figures were 8,916 and 8,840. The smaller diminution on the external side is explained by the fact that evacuation has not hit it as much as it has dislocated the collegiate side. Moreover, many serving members of the armed forces are pursuing courses of study as external students. The figures for 1941–1942 are not yet complete, but according to the *Journal* there appears to be a slight increase in both internal and external students. In the latter it is in faculties whose work is most directly related to the war effort—science and engineering—that numbers are best maintained. Turning to students attending schools of the university, there is a sharp distinction between the medical and non-medical schools. In 1940–1941 medical students were nearly 90 per cent. of the number for 1938–1939, while non-medical students were only 56 per cent. Before the war 63 per cent. of the students at non-medical schools were men; now the proportion is only 50 per cent. In the medical schools the proportion of 90 per cent. has scarcely changed. The main new problem during the year has arisen from the government's decision to call up women for national service, which has had an immediate effect on the position of women students.

DISCUSSION

THE PRODUCTION OF TWO ANTIBACTERIAL SUBSTANCES, FUMIGACIN AND CLAVACIN

The successful utilization of penicillin, produced by the fungus *Penicillium notatum*, for combating certain human diseases resistant to other treatments has focussed attention upon the possibility that various other fungi isolated from such natural substrates as soil or manure might produce different antibiotic substances. These might possibly supplement penicillin by acting upon pathogens not affected by this substance. Chemical compounds might thus be obtained which possess totally different antibacterial mechanisms. Several fungi, other than *P. notatum*, have already been shown to produce antibiotic substances; some of these have been isolated in crystalline form and identified chemically, whereas others have been obtained only in a concentrated active form.[1] In a study of the presence of antagonistic fungi in nature, the bacteria-enriched agar media[2] have been utilized.

[1] H. Raistrick and G. Smith, *Chem. Ind.*, 60: 828–830, 1941; A. E. Oxford, H. Raistrick and G. Smith, *ibid.*, 61: 22–24, 48–51, 1942; E. C. White, Science, 92: 127, 1940; G. A. Glister, *Nature*, 148: 470, 1941.

[2] S. A. Waksman and H. B. Woodruff, *Jour. Bact.*, 40: 581–600, 1940.

More than 160 cultures of antagonists were thus isolated from soils, manures and composts.[3] These fungi were divided into nine groups on the basis of their taxonomic and physiologic relationships and were found to vary greatly in their capacity to produce antibacterial substances.

Of these antagonistic fungi, two species of *Aspergillus* were studied in greater detail: *A. fumigatus*, of which 16 strains were isolated from different soils, and *A. clavatus*, represented by 3 strains isolated from stable manure. In synthetic media, these two organisms produced active substances, that differed greatly in their chemical nature and in biological activity. These two substances were designated as *fumigacin* and *clavacin*, respectively.

Fumigacin is readily soluble in chloroform and in ethyl alcohol and to a limited extent in ether and in water; it precipitates from an alcoholic solution, on cooling, as fine, long, needle-shaped crystals. The substance is active against gram-positive bacteria but has only limited activity against gram-negative forms, as represented by *Salmonella* and the colon-aerogenes groups. Fumigacin is isolated from the medium by adsorption on norit, and subsequent elution with chloroform, after preliminary treatment of the norit with ether. The chloroform is removed by distillation and the active substance is dissolved in alcohol. Fumigacin is markedly different from the pigment fumigatin, isolated by Raistrick and associates,[4] in its mode of formation, chemical properties and biological activity.[5]

Clavacin is soluble in ether, chloroform, alcohol and water. As yet, it has not been isolated in crystalline form. It can be extracted from the culture medium by direct treatment of the culture filtrate with ether and chloroform, or it can first be adsorbed on norit and then removed from the latter by means of these solvents. It is readily soluble in dilute alkalies. Clavacin is particularly active against gram-negative bacteria, the colon-aerogenes group being nearly as sensitive as staphylococci and spore-forming bacteria. Another important characteristic of this substance is its high bactericidal property. It is known that most antibiotic substances act upon bacteria primarily as a result of their bacteriostatic properties; they are rather weakly bactericidal. Clavacin appears to be distinct from these in this respect, possessing both high bacteriostatic and high bactericidal properties, 6 to 18-hour-old cultures of various gram-negative and gram-positive bacteria being killed within 2 to 6 hours by dilution of 1 : 50,000 to 1 : 500,000 of the crude clavacin.

The substance recently isolated by Wiesner[6] from *A. clavatus* appears to be similar to clavacin, if not identical with it.

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[3] S. A. Waksman and E. S. Horning. In press.

[4] W. K. Anslow and H. Raistrick, *Biochem. Jour.*, 32: 687–696, 1938; A. E. Oxford and H. Raistrick, *Chem. Ind.*, 61: 128–129, 1942.

[5] S. A. Waksman, E. S. Horning and E. L. Spencer. In preparation.

[6] B. P. Wiesner, *Nature*, 149: 356–357, 1942.

NATURAL PROTECTION AGAINST SUNBURN

EVERY one knows that skin which has been exposed to sunlight is less likely to sunburn than skin that has not been exposed. However, the explanation usually assigned is only partially correct at best. Skin which has been exposed ordinarily assumes a brown or tan color, principally due to the formation of melanin pigment,[1] and Finsen[2] about 1900 suggested that this pigment acts as an effective screen to mitigate the action of the sun's rays. This explanation seems so logical that it has been almost universally accepted. However, the pigment is located principally in the basal cell layer of the epidermis, whereas findings subsequent to Finsen's show that the cells primarily affected in sunburn are chiefly the prickle cells which lie superficial to most of the pigment. This arrangement of the pigment is characteristic of white skin, whereas in Negro skin it is more evenly distributed throughout the epidermis.

About 1927 Guillaume[3] suggested that the thickening of the corneum or horny layer of the epidermis might be the principal protective factor, *i.e.*, the thickening of this layer should decrease the amount of radiation penetrating to the cells beneath. This suggestion was followed up by Miescher,[4] who showed that sufficient thickening of the corneum occurs after exposure to sunlight to provide effective protection.

In the disease, *vitiligo*, certain areas of the skin do not produce pigment, but exposure of these areas to ultraviolet radiation causes a decrease in sensitivity to subsequent exposure.[5] This is further evidence that pigment is not the sole protective agent.[6]

[1] See E. A. Edwards and S. Q. Duntley, SCIENCE, 90: 235, 1939.

[2] N. R. Finsen, *Mitt. Finsens Med. Lysinstitut*, 1: 8, 1900.

[3] H. C. Guillaume, "Les Radiations Lumineuse en Physiologie et en Therapeutique," Paris, Masson et Cie, 1927.

[4] G. Miescher, *Strahlentherapie*, 35: 403, 1930.

[5] C. With, *British Jour. Dermatol. and Syph.*, 32: 145, 1920.

[6] For additional discussion and references see: F. Ellinger, "Radiation Therapy," New York, Elsevier Publishing Company, 1941; H. F. Blum, "Photodynamic Ac-

Demonstration that the transmission of the sunburn-producing wave-lengths by the epidermis of the albino mouse is greatly decreased by exposure of the animal to such radiation adds further evidence.[7]

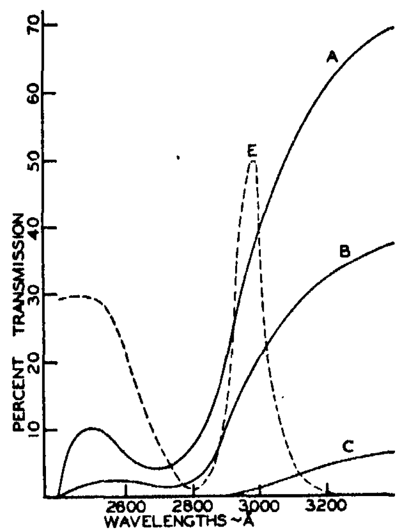

FIG. 1. A: Transmission of normal epidermis of albino mouse ear. B; Transmission of epidermis of ear of albino mouse exposed to ultraviolet radiation for 31 weeks. C; Transmission of well-pigmented epidermis of forearm of man. E; action spectrum of erythema of sunburn of man. This curve is not accurately established for the mouse but has approximately the same long wave-length limit.

These animals do not, of course, form melanin pigment, and hence the decreased transmission of the epidermis must result from some other change. The horny layer is thickened in the exposed animals, and this offers the most probable explanation for the decreased transmission. Fig. 1 illustrates this change in transmission in the region of wave-lengths that cause sunburn, together with curves of transmission by human epidermis.

None of this evidence completely rules out melanin as a factor in protection against sunburn. It shows, however, that it is not the only factor, and probably not the major one in the case of white skin. The melanin must function effectively in preventing penetration of the radiation below the epidermis, which may be of considerable importance in determining the site of cutaneous cancer.[7]

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tion and Diseases Caused by Light,'' New York, Reinhold Publishing Corporation, 1941.

[7] J. S. Kirby-Smith, H. F. Blum and H. G. Grady, *Jour. Nat. Cancer Inst.*, 2: 403, 1942.

THE LISTING OF MEDICAL SCHOOLS

MAY I be permitted, as one long interested in collegiate statistics, to point out what I consider an unfortunate aspect of the article "Research Activity and the Quality of Teaching in Medical Schools," by Dr. Albert E. Casey, of the Louisiana State University, published in SCIENCE for July 31, 1942. I shall not discuss the validity of state board medical examinations as a criterion for the quality of medical teaching. I do wish to comment upon the publication in 1942 of a listing of medical schools based upon articles by faculty members appearing in medical journals from March, 1932, to March, 1934. The use of statistics which date back eight years or more to another decade is by no means justified by the back-handed statement that "Sufficient time has elapsed so that the standing of the schools need not necessarily be that of 1934."

The years since 1932–34 have been a period of notable personnel changes in medical faculties of the schools listed and consequent changes in research activity. For example, at the College of Medicine of the University of Cincinnati, our records show that the publications of research for the calendar years 1940 and 1941 are approximately twice those for the years 1932 and 1933. It is my impression that there have been similar advances at Duke, Vanderbilt, Louisville and other medical schools. To sum up, my fear is that Dr. Casey's listing of medical schools, based on old data, will be popularly quoted as representing their present status in respect to research activity and publication.

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THE SHOT-PUT AND THE EARTH'S ROTATION

IN a most estimable weekly magazine having a circulation of millions is a department designed to enable its readers to keep up with the world. Once the editor of that department assured us that mercury poured into an open dish remained undiminished in weight, as though mercury gave off no vapor. Recently that department assured us that on account of the earth's rotation an athlete can put the 16-pound shot farther toward the east than toward the west. We are skeptical, for although it is quite true that the athlete while hurling the shot toward the east is moving toward the wished-for mark with a velocity of about 17 miles per minute, the mark at which he aims is moving away from him with that same velocity, with the net result that his shot-put is precisely the same as though the earth were standing still; similarly, if he puts the shot toward the west. Since a body moving south gradually grows lighter his put toward the south might per-

haps exceed his northward put by the thousandth part of a micron.

If the athlete is determined to utilize the earth's rotation in beating the present record of about 56 feet he should go to a theological seminary and learn how the prophet Joshua in his blitzkrieg against the Amorites made sun and moon stand still by stopping the earth's rotation. Armed with this knowledge, he could, immediately after putting the shot toward the east, stop the earth's rotation, and have the satisfaction of beating the record by several miles.

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STATEMENT

IN my radio address printed in SCIENCE for July 3, 1942, I used a phrase commencing: "Frequently we become conscious of the philosophy of the old darky. . . ." It has come to my attention that the use of the word "darky" is likely to hurt the feelings of members of the Negro race. I need hardly say that anything approaching an unkindly wording was farthest from my intention, and I am deeply grieved that the wording I used may have caused offense. Being unfamiliar with the implications involved in the word "darky," I used that designation as conveying to the mind, for the purposes of my illustration, the lovable characteristics of an individual who might never have had the opportunity of a formal education but had, nevertheless, thought much of his own accord and, endowed with a certain richness of experience in life, had come to philosophize in a really profound manner upon certain situations arising out of that experience. I never liked the word "Negro" as it sounded harsh and discriminatory, and I used the designation "darky" in the same way as I might say: "There was a canny old Scot who remarked. . . ."

Again may I express my very deepest regret at the unfortunate implication contained in my words, which I am sure my many friends in the Negro race, and particularly those in my own profession, will realize were uttered without any thought that they could hurt the feelings of a race for which I have the warmest regard.

W. F. G. SWANN

QUOTATIONS

WAR METALLURGICAL RESEARCH

FRANK B. JEWETT, president of the National Academy of Sciences, announces that the academy's Metals and Minerals Advisory Committee for the past 18 months has furnished OPM and WPB with 113 reports. Fifty-three of these were on metals substitution and conservation, 47 on ferrous minerals and ferroalloys, 4 on tin smelting and reclamation, and 9 on nonmetallic minerals. These reports, prepared by the various subcommittees of the Advisory Committee, dealt principally with problems arising from the necessity for allocation and substitution of materials, not only for general civilian uses, but even more particularly for war production processes and increased production of war materials.

The work of this advisory committee, according to Dr. Jewett, has been greatly enlarged since Pearl Harbor and is to be further increased as it functions with and for the new War Metallurgy Committee. Clyde Williams, director of Battelle Memorial Institute, Columbus, Ohio, and chairman of the advisory committee, is also chairman of the new War Metallurgy Committee which has primarily been set up to appraise and conduct needed research work for the Army, the Navy and other governmental departments as well as industry. This committee is composed of 26 members, the advisory committee of 63 regular members, plus special members, and 20 other specialists frequently are called in for advice on specific problems. Associations and technical societies are also taking an active part in the problems of metallurgical reports and research.

It is the function of the War Metallurgy Committee to collect data and information as requested by either the WPB or the Office of Scientific Research and Development, through its National Defense Research Committee, and to plan, present and supervise definite research projects for either war materials or armaments. The War Metallurgy Committee and its Advisory Committee, according to Dr. Jewett, is set up to function as the nerve center for all metallurgical research organizations and departments in this country. The heads of any business, university or research organization can be counted upon by this committee to make available the experience of their metallurgical scientists and engineers or their laboratory data. There are in excess of 10,000 such individuals in this country, and their combined experience represents well over 125,000 man-years.

One of the basic considerations in the operation of this committee is that of saving time, mistakes and money. When a problem is proposed, through either the WPB or the Office of Scientific Research and Development, immediate action can be obtained by telephone communication with the leading scientists on that particular subject; initial committee meetings are

often held within 24 hours and, if the request is urgent, within the same day a plan of procedure is laid down and submitted.

Every one in this country, and scientists and industrialists are no exception, is naturally anxious to contribute everything he can toward winning the war. New thoughts, new ideas, new short cuts, are constantly coming to the front. While it is not the place of the War Metallurgy Committee, according to Dr. Jewett, to be the repository for such suggestions and ideas, it recognizes as a very definite part of its wartime job the appraisal of such of these problems and possibilities as are referred to it by the WPB or the Office of Scientific Research and Development.

Another important function of the War Metallurgy Committee is to digest and make available to those properly interested through their participation in the war effort the results of both Canadian and English metallurgical research. Obviously both Canada and England have a great many of the same problems which confront us, and the interchange of information makes available to all the best thinking and practice of scientists and industrialists on both sides of the Atlantic.

Typical of the problems referred to this committee is one asking for improvement in welding processes. A subcommittee was immediately appointed, which collected all available known data from universities, engineering foundations and research departments of business organizations. The Project Section of the War Metallurgy Committee worked up the research indicated and research procedure; with the approval of the National Defense Research Committee and the Office of Scientific Research and Development, this research was placed with one of the university laboratories and compensated for on a cost basis from funds made available by OSRD.

Typical of requests for data and projects from the WPB is that of the effect of substitution of lead-silver for tin-lead soldering of tin cans used for food products. Since tin is the one important metal which is not found in the United States, even in low-grade ores, it is obviously important that the conservation of the present use of tin is urgent. Since a great proportion of the total consumption of tin is used in soldering, the substitution of lead-silver for tin-lead soldering is immediately dictated, but the problems involved in certain canning processes are such that definite research is needed before such substitution can be ordered.

This research project was prepared through the Project Section of the War Metallurgy Committee and will be administered through its research section, the work being done in one large university research laboratory, in cooperation with the National Canners Association.—*Chemical and Engineering News.*

SCIENTIFIC BOOKS

ASTRONOMY

Foundations of Astronomy. By W. M. SMART. 268 pp. 119 illustrations. London: Longmans, Green and Company. 1942.

THE preface of this excellent text announces that it "is intended for students taking a first-year course in Astronomy in the Universities and for all those interested in the subject who feel the need for a more solid foundation than the many descriptive books can provide." The book is definitely not descriptive in character; in the entire volume, there is not a single photograph or drawing of a celestial body. Only seven pages are devoted to the description of the sun, moon, planets, comets, minor planets and meteors, while nine pages are devoted to atmospherical refraction, fourteen to parallax and seventeen to aberration, precession and nutation. On the other hand, the volume is generously supplied with diagrams and sketches, clearly lettered, to help in the understanding of the text.

Although the book is essentially mathematical in character, the reader does not need a strong mathematical background to read it; nothing beyond a knowledge of elementary trigonometric functions is required. Only the cosine formula of spherical trigonometry is derived; the sine formula and several others are merely stated. The applications of the spherical trigonometric formulae are rather limited in number.

Five of the early chapters, "The Geometry of the Sphere," "The Celestial Sphere," "Right Ascension," "Mean Time" and "Determination of Position on the Earth," contain information needed as background by the student of navigation. Some of the terms used and the definitions given differ from standard American practise, enough to decrease considerably the value of the book to a person in the armed forces of the United States. For example, "true bearing" as defined by Smart is identical with "azimuth" as defined by the U. S. Navy; each is measured from the north point of the horizon to the east to 360°. "Azimuth" as defined by Smart is measured from the north point of the horizon in the northern hemisphere, from the south point of the horizon in the southern hemisphere; in either case, it is measured to the east or to the west to 180°. For purposes of computation, this definition is very convenient. He naturally pre-

sents the British measure of the nautical mile, 6,080 feet rather than the American, 6,080.27 feet.

In the discussion of time, the author carefully clears up one point on which there has been considerable confusion—the precise meanings of Greenwich Mean Time, Greenwich Civil Time and Universal Time, indicating the common usage of each in the United States and Great Britain.

Ten to twenty problems are provided at the end of each chapter to illustrate the principles therein; answers are given to all in the back of the book. The four chapters making up the last quarter of the book, "The Stars," Stellar Motions," "Clusters and Nebulae" and "Telescopes," also contain a minimum of description. The material throughout the book is up to date and clearly presented. The book fills a need for a modern text in elementary mathematical astronomy.

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SOCIETIES AND MEETINGS

THE AMERICAN PHYTOPATHOLOGICAL SOCIETY

THE summer meeting of the American Phytopathological Society was held at Toledo, Ohio, on June 25 and 26. The theme of the discussions and reports was "The Role of the Plant Pathologist in the War Program." The activities of the War Emergency Committee, which was appointed at the Dallas meeting, were thoroughly discussed and suggestions for future activities were made. Considerable factual information was given in reports of available fungicides, substitute sprays and seed-treating materials and equipment priorities.

It was brought out that the depletion of the ranks of scientifically trained men constitutes a serious menace not only to present essential services to agriculture, but also jeopardizes the future because of the discontinuance of certain basic researches that are essential in furnishing a basis for intelligent action in plant disease control measures.

It was pointed out that losses from preventable diseases are still appalling. Epidemics often rage unchecked because proper control measures either are not taken at all—because they are not adequate, or because information regarding control measures had not been disseminated widely enough and at the proper time because of lack of sufficient trained personnel. One of the first and most important duties of plant pathology is prompt dissemination of information regarding the best available control measures. This responsibility can not be discharged properly under present conditions. A survey of the situation with respect to extension plant pathologists in the country indicates that very few states have an adequate extension service. Some states have no extension plant pathologist at all, and some of the most important agricultural states have a single extension plant pathologist, when two or three are needed. In only very few states can the situation with respect to extension work be considered satisfactory. Pathologists themselves are trying to do what they can by assembling and exchanging information, but the situation can not be alleviated properly until more men are made available for this very important phase of insuring the nation's supplies of essential materials from economic plants.

The following fields of research were cited as among those important to the nation's war effort: A better organized nation-wide plant disease survey service, fostered by the survey subcommittee, for effective direction of crop protection programs; work on new and improved fungicides and crop protection methods led by the fungicide subcommittee; development of disease-resistant crop varieties with coordinated, local trials under special subcommittees; research led by the seed certification and seed treatment committees on problems basic to certification or treatment of seed and planting stocks to reduce losses from seed- and plant-borne diseases; research on rotations, chemical treatment and cultural management of soils to reduce losses from soil-borne diseases; coordinated research on virus diseases of plants with entomologists helping on insect carriers; prompt investigation of newly discovered, potentially destructive plant diseases; research on diseases of new crops being grown to meet war-time shortages of oil, fibers, drugs, spices, etc.; more general study of soybean diseases; and work on effective home-made dusting, spraying and treating equipment where commercial equipment is unavailable.

It was brought out that the society's national and regional war emergency organization was well adapted for prompt exchange of research information. The necessity for adequate, coordinated plant disease survey work was repeatedly emphasized. Helpfulness of specialists in performing identifications for colleagues was commended. The *Plant Disease Reporter* was declared useful in facilitating such collaboration and for prompt dissemination of important new findings. Voluntary cooperation for adequate attack on many plant-disease problems was stressed. The tremendous national importance of plant disease eradication and control programs was said to demand their maintenance at highest efficiency during the emergency.

The War Emergency Committee consists of an executive committee, representatives of five geographical divisions, and members selected at large. Various subcommittees of the national committee have been appointed to take care of specific problems. The national committee is cooperating closely with the regional committees.

Executive Committee: J. G. Leach, University of West Virginia; Richard P. White, 636 Southern Building, Washington, D. C.; E. C. Stakman, *chairman*, University Farm, St. Paul, Minn.

The general objectives formulated by the committee are as follows:

(1) To provide for more adequate plant disease quarantines, foreign and domestic, to guard against introduction and distribution of new and destructive disease organisms.

(2) To intensify plant disease surveys to detect as soon as possible new disease introductions and to show where control efforts should be concentrated.

(3) To summarize and codify known control measures and make them available to extension men and growers in easily comprehensible form, and to encourage more adequate extension work in plant pathology.

(4) To attempt to get necessary priorities on chemicals and machinery used in controlling diseases.

(5) To concentrate effort on necessary experimentation and research designed to improve the effectiveness and economy of plant-disease control measures, by cultural practices, chemical treatments and resistant varieties.

(6) To summarize information regarding preservation of food and other products in storage and transit, make it available and provide for necessary studies to meet new situations.

(7) To scrutinize present basic and long-time research projects with a view to procuring support for those that are designed to yield facts and principles on which important procedures are based and those that could not be interrupted without serious loss of materials, accumulated results and experience.

(8) To maintain adequate personnel.

SPECIAL ARTICLES

THE EFFECTS OF JEJUNAL TRANSPLANTS ON GASTRIC ACIDITY[1,2]

ALTHOUGH a number of investigators have transplanted segments of jejunum into the wall of the stomach of animals for the purpose of observing the fate of such grafts, we are not aware of any published studies of the effects of such a procedure on gastric secretion. We wish therefore to report some observations on the free and combined acidity of the gastric secretion and the pH of various parts of the mucosa of the stomach before and after implantation of a pedicle graft of the jejunal wall.

Method: Mongrel dogs of both sexes were used for the experiments, which consisted in the resection under nembutal anesthesia of an area of the anterior wall of the stomach about 4×6 cm in size, midway between the cardia and pylorus, and the implantatiòn into the resulting defect of a pedicle graft of upper jejunum with its circulation intact. This was obtained by isolating a segment 6 cm in length which was then opened along its anti-mesenteric border and fastened in place by means of interrupted sutures of silk. The continuity of the jejunum was restored by end-to-end suture.

The gastric secretion of each animal had been examined under nembutal anesthesia after 24 hours' fast at least once before beginning the experiments. At the time of operation direct measurements of the pH of the surface of the mucosa at seven definite areas in the stomach were made by inserting electrodes of the Beckman pH Meter through the defect in the anterior wall just prior to the implantation of the jejunal graft.

Subsequent gastric analyses were carried out in a similar fashion and pH determinations were made from 45 minutes to four months after the implantations, inserting the instrument through a gastrotomy. In two instances the transplant was then resected and further observations carried out.

Control animals were subjected to operations of similar length, as well as to resection of an area of the anterior wall of the stomach, after which the defect was closed without transplant.

The effects of this procedure on gastric secretion are most interesting, a striking feature being a reversal of the normal response to histamine in four of the five

TABLE I

pH OF GASTRIC MUCOSA BEFORE AND AFTER JEJUNAL TRANSPLANT
AVERAGE FIGURES FROM FIVE ANIMALS

	Before transplant			After transplant		
	Fasting	10 min. after histamine	20 min. after histamine	Fasting	10 min. after histamine	20 min. after histamine
Pylorus	4.0	2.3	2.3	5.2	5.4	6.0
Anterior antrum	5.0	3.7	2.7	5.7	6.1	6.1
Posterior antrum	4.3	3.2	2.7	5.7	6.5	5.9
Lesser curvature	4.8	1.9	1.4	5.2	7.0	5.9
Greater curvature	5.1	2.8	1.4	4.2	6.3	5.8
Fundus	5.2	3.5	1.5	3.6	6.3	5.8
Cardia	4.4	2.0	1.6	3.0	4.0	5.0
Composite averages	4.8	2.6	1.9	4.9	5.9	6.0

[1] From the Department of Surgery of the New York Hospital and Cornell University Medical College, New York.

[2] This study was carried out under a grant from the John and Mary R. Markle Foundation.

animals and a marked reduction in the fifth as demonstrated in the pH of the gastric mucosa of seven different regions of the stomach. These values appear in Table I, reference to which indicates that while in the average figures for five animals the fasting pH shows little change, the level after histamine is considerably elevated following the implantation of the jejunal segment.

The effect on the gastric analysis is also consistent and definite. Here the average fasting free and combined acidities are diminished somewhat after the jejunal transplantation has been performed and a further decrease occurs following histamine (Table II). Particularly noteworthy is the fact that the combined acidity is lower in each instance following operation, indicating that the reduction in free acidity is not to be explained on the basis of neutralization of the gastric juice by the alkaline secretion of the jejunal mucosa.

TABLE II

GASTRIC ANALYSES BEFORE AND AFTER JEJUNAL TRANSPLANTS

	Before transplant			After transplant		
	Fasting	10 min. after histamine	20 min. after histamine	Fasting	10 min. after histamine	20 min. after histamine
Dog No. 1839						
Free	60	92	70	24	12	5
Combined ...	38	44	65	26	36	30
Total	98	136	135	50	48	35
Dog No. 1841						
Free	60	78	90	40	20	10
Combined ...	56	60	44	36	22	20
Total	116	138	134	76	42	30
Dog No. 1842						
Free	50	70	87	44	30	8
Combined ...	45	60	58	40	36	32
Total	95	130	145	84	66	40
Dog No. 1887						
Free	40	48	60	36	36	22
Combined ...	35	38	34	30	20	12
Total	75	86	94	66	56	34
Dog No. 1888						
Free	42	50	63	50	42	30
Combined ...	50	46	40	30	28	20
Total	92	96	103	80	70	50
Averages						
Free	50	68	74	39	30	15
Combined ...	45	50	48	32	28	23
Total	95	118	122	71	58	38

These changes have been shown to occur within 45 minutes of the transplantation and in the completely studied animals to persist for at least four months.

In two animals when the effects of the transplant were established, it was then resected and further pH measurements carried out. These indicated that within one hour one animal, number 1723, showed the normal reaction to histamine, although the fasting pH remained slightly higher than before the graft was implanted. In the other, number 1839, the pH of the mucosa and its reaction to histamine corresponded to the normal findings in all respects.

Further studies of the effect of such transplants on other aspects of gastric secretion are in progress.

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THE EFFECTS OF ANTI-MICROBIAL SUBSTANCES OF BIOLOGICAL ORIGIN UPON BACTERIAL TOXINS[1]

DURING recent years, the anti-microbial properties of various substances produced by different bacteria and fungi have been studied extensively and some of them have been utilized as chemotherapeutic agents in the treatment of infections of animals and man. Among the more important of these substances are the following: Pyocyanase, isolated from *Pseudomonas aeruginosa* by Loeb; penicillin, obtained by Fleming from *Penicillium notatum;* tyrothricin (gramicidin and tyrocidin) isolated by Dubos and Hotchkiss from *Bacillus brevis;* and actinomycin A and B isolated by Waksman from *A. antibioticus.* Although the action of these substances upon growth and survival of many bacteria and fungi is now well known, only scant information is available in regard to possible effects upon bacterial toxins. It has been stated that pyocyanase inactivates diphtheria toxin.[2] Tyrothricin and actinomycin A inhibit fibrinolysis by *beta hemolytic streptococcus* and plasma coagulation by pathogenic staphylococcus.[3] However, it is not known as yet whether these substances act directly upon fibrinolysin and coagulase themselves. In the following communication, the results of experiments on the effects upon bacterial toxins of various anti-microbial substances of biological origin are presented.

Tyrothricin, actinomycin A, pyocyanase and dimethyl-benzylammonium chloride (Zephiran) were tested for possible antitoxic activity. The latter substance was included because it is a mixture of alkyl radicals from C_8H_{17} to $C_{18}H_{37}$ as contained in the corresponding fatty acids of cocoanut oil. Tetanus toxin was diluted either in buffer solution (pH 7.2) or in infusion broth and then mixed with appropriate amounts of the respective substances. The mixtures were injected subcutaneously into the leg of white mice (18 to 24 g) either immediately or following incubation of 37° C for various periods of time. The animals were observed daily for the development of

[1] The author wishes to express his appreciation to Dr. D. F. Robertson, associate medical director, Merck and Company, for tyrothricin and pyocyanase; to Dr. Edwin F. Voigt, Director, Human Biological Division, Lederle Laboratories, for tetanus and diphtheria toxin; and to Dr. Selman A. Waksman, State of New Jersey Agricultural Experiment Station, New Brunswick, for actinomycin A.

[2] R. Emmerich, O. Loew and A. Korschun, *Zentr. Bakt. Parasitenk.*, 31: 1–25, 1902; Okhubo, *Z. Immunitaesf.*, 5: 428, 1910.

[3] E. Neter, *Proc. Soc. Exp. Biol. Med.*, 49: 163–167, 1942.

local or generalized tetanus and death. A few experiments were carried out with diphtheria toxin; guinea-pigs weighing from 150 to 250 g were used in these studies.

The experiments revealed that tyrothricin (0.05 mg and less) has no immediate effect upon the toxicity of tetanus toxin. The mixture of tetanus toxin and tyrothricin causes tetanus just as tetanus toxin alone. However, tyrothricin has a marked effect upon tetanus toxin which has been diluted in physiological salt solution or in buffer solution and kept either at 37° C or 4° C for 24 hours or more. Such a diluted toxin loses rather rapidly in toxicity. Tyrothricin in amounts of 0.05 mg to 0.000005 mg partially or completely inhibits this loss of toxicity of tetanus toxin. In one particular experiment, for instance, diluted tetanus toxin, which had been incubated together with tyrothricin at 37° C, caused tetanus and death, whereas the tetanus toxin control had become completely devoid of toxicity. It is interesting to note that tyrothricin also inhibits the loss of toxicity of tetanus toxin which has been exposed to heat (55° C). In regard to the mode of action, it may be pointed out that tyrothricin is a mixture of two polypeptides, namely, gramicidin and tyrocidin, and that peptones likewise inhibit the loss of toxicity of diluted tetanus toxin.[4] No evidence was obtained that tyrothricin increases the toxicity of tetanus toxin *per se*. It does not prevent the neutralization of tetanus toxin by the homologous antitoxin. Tyrothricin also inhibits the loss of toxicity of diphtheria toxin which has been diluted in physiological salt solution or buffer solution and kept at 37° C or 4° C.

Actinomycin A, an orange-colored pigment with marked bacterio-static activities, has no effect upon the toxicity of either diphtheria or tetanus toxins: in amounts of 0.005 mg and less, it neither prevents the loss of toxicity of these toxins which have been diluted in physiological salt solution, nor does it inhibit or enhance their toxicity.

Pyocyanase exerts a definite effect upon tetanus toxin. A preparation of pyocyanase was obtained from Merck and Company through the kindness of Dr. D. F. Robertson. It is a brownish, black slave-like material, soluble in ether and alcohol, but mainly insoluble in water. Following incubation for 24 to 48 hours, this pyocyanase preparation in amounts of 1 mg inhibits the toxic and lethal effects of tetanus toxin. This effect takes place in the presence of broth. Injection of tetanus toxin immediately after the addition of pyocyanase resulted only in a slight delay of the appearance of signs of tetanus.

Zephiran, too, exerts a definite effect upon tetanus toxin. In dilution of 1: 10,000, it completely prevents the toxic effects of tetanus toxin in mice, even when the toxin is injected immediately following the addition of this substance. It is important to note that the effects of zephiran upon tetanus toxin are somewhat inhibited in the presence of infusion broth and even more so in the presence of human serum.

The foregoing experiments revealed that certain substances of biological origin with marked anti-microbial properties, such as pyocyanase and zephiran, inhibit the *in vivo* effects of tetanus toxin. Whether or not they irreversibly inactivate the toxin and change its antigenic pattern, remains to be determined. Certain others, such as tyrothricin, inhibit the loss of toxicity of tetanus and diphtheria toxins which have been diluted in physiological salt or buffer solution. The effects upon other bacterial toxins need further investigation, and it remains to be seen whether the antitoxic properties of antimicrobial substances of biological origin can be utilized with efficacy and safety in the treatment of localized and generalized infections in which bacterial toxins play an important role.

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[4] K. Halter, *Zeitschr. Hyg. Infektionskr.*, 118: 245–262, 1936.

CAROTENOIDS OF TELIAL GALLS OF GYMNOSPORANGIUM JUNIPERI-VIRGINIANAE LK.[1]

THE rust fungus *Gymnosporangium juniperi-virginianae* Lk. infecting the common juniper (*Juniperus virginiana* L.) forms caulicolous galls, globoid or reniform in shape, varying in diameter from 5 to 30 mm or more. The aeciospores produced during the summer on the cultivated apple are transferred to the juniper and cause infection. The mycelium remains dormant until the following spring when the telial galls become visible. These galls grow throughout the summer, mature in the fall and give rise to the teliospores the next spring.[2]

The mature galls used in this work were gathered when the telia were 1 to 2 mm in diameter by 5 to 10 mm long. The galls ranged in size from 10 to 50 mm in diameter and were of a cedar-brown color, while the telia were of a deeper reddish brown.

The leaves of the juniper contained 50 per cent. water at the time of gathering the galls, while the galls contained 68 per cent. water. The color of the interior of the galls when opened was pale green near the rind, while the body was light yellow. On exposure to the air, however, this color deepened to

[1] Contribution No. 274 from the Department of Chemistry.

[2] F. L. Stevens, "The Fungi Which Cause Plant Disease." Macmillan, 1921.

orange-yellow. Microscopic examination of the crushed galls showed that they consisted largely of teliospores and mycelium with the color confined to the teliospores.

Entire galls weighing 10 to 15 g were diced, weighed and placed in Erlenmeyer flasks. One hundred ml of saturated alcoholic potash was added and the whole refluxed for one-half hour. The gall residue was separated by suction filtration and the residue mixed in a Waring blender for 2 minutes with 50 ml of alcohol. The mixture was again refluxed for 15 minutes and the alcoholic extracts combined.

Complete removal of all the carotenoids present was accomplished with three extractions, using small amounts of petroleum ether (b.p. 30–60°). The pigments were epiphasic against 90 per cent. methanol, indicating the absence of free or esterified xanthophylls.

The combined petroleum extracts were dried over anhydrous Na_2SO_4 and brought to a small volume by distillation *in vacuo*. They were then chromatographed by the Strain[3] technic, using as adsorbent a mixture of MgO and Hyflo Super Cel (1 : 1). Only two zones separated. The lower zone was subsequently shown by spectrum analysis to be β-carotene. The upper, more strongly adsorbed red-orange zone had absorption maxima in petroleum ether at 4600 Å and 4900 Å with a minimum at 4800 Å. The latter pigment, by its behavior on the adsorbent and its absorption spectrum, appears to be identical with γ-carotene.

The total carotene concentration of the gall was 3.31 mg per 100 g, of which 36 per cent. was β-carotene and 64 per cent. the γ-isomer. By comparison, a similar chromatographic study of the leaves gave 4.03 mg per 100 g of total petroleum-phasic carotenoids distributed as follows: 7 per cent. α, 83 per cent. β and 10 per cent. γ-carotene. Small amounts of xanthophylls were present in the leaves, but these were not investigated.[4]

The remarkably high content of the γ-isomer in the gall is of particular interest. This isomer is quite rare in plants, constituting only 0.1 per cent. of the total carotene prepared from ordinary sources.[5] Small amounts have been found in apricots (*Prunus armeniaca*).[6] Mackinney[7] has reported the marsh dodder (*Cuscuta salina*) to be a relatively rich source. Emerson and Fox[8] found a remarkably high concentration of γ-carotene in the male gametangia of the aquatic Phycomycete *Allomyces*. The latter workers point out the probability that "carotenoids may play important biological roles in sexuality and the process involved in the metabolism of reproduction."

The gall described is the richest source of γ-carotene which has come to the attention of the authors.

Summary

In an investigation of the pigments of the telial galls of the common rust fungus *Gymnosporangium juniperi-virginianae* Lk. β- and γ-carotenes were shown to be the only carotenoids present, with the γ-isomer predominating. The identification of γ-carotene was based on its more characteristic properties, behavior on an adsorbent, and its absorption spectra. Neither free nor esterified xanthophylls were present, and only traces of chlorophyll.

The leaves of the juniper, besides containing chlorophyll, showed the presence of α-, β- and γ-carotene.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

CHROMATOGRAPHIC ANALYSIS IN REVERSE

The adsorption of substances from solution has generally been accomplished in one of two ways: by shaking the solution with the adsorbent and then filtering or by means of a chromatographic adsorption column. In the latter, the solution is allowed to percolate through a column packed with an adsorbent and the various adsorbable substances in the solution form bands in the adsorbent column, which can later be removed and eluted separately.

Because of the recognized value of chromatographic analysis, a modification of this technique found in this laboratory appears to have interesting possibilities as a research method. This modification consists in reversing the usual Zwett technique. Instead of passing the solution through the adsorbent column and then separating the bands by washing, the solution is placed in a tube and the adsorbent allowed to settle slowly through it, a small portion at a time. The powdered adsorbent falling through the solution sets up eddy currents which mix the solution sufficiently.

[3] H. Strain, *Jour. Biol. Chem.*, 105: 523, 1934; *ibid.*, 111: 85, 1935.

[4] M. Tswett has reported the presence of the xanthophyll, rhodoxanthin, in *Juniperus virginiana*. *Compt. rend.*, 152: 788, 1911.

[5] R. Kuhn and H. Brockmann, *Naturwiss.*, 21: 44, 1933; *Ber.*, 66: 407, 1933.

[6] H. Brockmann, *Z. physiol. Chem.*, 216: 45, 1933.

[7] G. Mackinney, *Jour. Biol. Chem.*, 112: 421, 1935.

[8] R. Emerson and D. L. Fox, *Proc. Royal Soc. London*, 128: 275, 1940.

Tubes of various sizes may be used. Best results have been obtained using tubes of 4 to 12 mm inside diameter and 100 cm long. The tube is mounted vertically. This is important, since otherwise the solid will tend to pile up unevenly on the bottom and will not settle uniformly through the solution. A small funnel is attached with a rubber tube to the top end and the bottom is closed with a cork. Placing a funnel at the top of the tube makes it easier to add the adsorbent to a small tube without spilling. It also allows the powder to be wetted by the solvent and to fall slowly through the narrow neck of the funnel in such a way that it does not enter the tube in lumps. Six or more inches of the tube (depending on the total length) are filled with pure solvent and the solution to be treated is carefully poured on top of it. The tube is filled completely, the liquid extending up into the small funnel to a depth of several centimeters. The powder is added in equal measured amounts of 0.2 to 1 gram. The accuracy of separation which is desired determines the size of the portions, and this in turn depends on the width of the tube, the quantity of substance to be adsorbed and the ease with which it is adsorbed.

In a solution containing three adsorbable substances, A, B and C, whose affinity for the adsorbent decreases in the same order, a portion of adsorbent settling through the solution will adsorb substance A first. The following portions will continue to adsorb A as long as any remains in solution. When A is removed further adsorbent will begin to adsorb B and finally C in succession. If such substances are colored, the column of the settled layers of adsorbent thus built up will be found to be colored by A on the bottom, then by B and finally by C, while the top layer will be entirely colorless if an excess of adsorbent has been added. It is interesting to observe by this method that more strongly adsorbed solutes are eluents for less strongly adsorbed substances. This is, of course, obvious by definition, but is clearly demonstrated in the apparatus described. When several portions of adsorbent have passed through the tube and have adsorbed all substance A from the upper part of the tube, some will still remain in the lower portion. The next portion of adsorbent will adsorb substance B in the upper part of the tube and, as it falls further, will lose the color due to B and assume the color due to A because the B has been eluted by the more strongly adsorbed A remaining in the lower part of the tube. When finally all the A is gone and B is only present in the lower parts of the tube, the process is repeated by C being adsorbed at the top and then being eluted by B as it falls into the lower end of the tube.

The relative adsorptive abilities of two different materials can easily be determined by adding first one and then the other. When colored materials are being adsorbed, the least effective adsorbent will be least colored and will also serve to mark the positions of adjacent portions of the more active adsorbent. This effect can be utilized by using a non-adsorbing white powder with colored substances and a colored non-adsorbent when colorless substances are being treated. The addition of a small amount of such inert material between portions of adsorbent in this way very clearly indicates their position in the column thus built up and is a help in correctly sectioning it at the end of the experiment.

After the last portion of adsorbent has settled, the solvent can be carefully poured off and the tube allowed to drain. Then the cork is removed and the whole core pushed out and sectioned into its components. It is better to add quite a little adsorbent above the last colored layer so that when the solvent is poured off, just a little of this unimportant material will slide down the tube with the solvent while the desired portion of the core is not disturbed.

Investigation of this matter has been an incidental result of other work, the more pressing nature of which has, as yet, precluded further development of its potentialities. However, it is thought that the method has wide possibilities as a research tool in the field of adsorption analysis and may prove to be applicable to cases not amenable to methods previously described. Consequently, this method is brought to the attention of other research workers with the hope that those having the knowledge of the pitfalls and advantages of adsorptive procedures will investigate and develop it further.

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BOOKS RECEIVED

Advances in Internal Medicine. J. MURRAY STEELE, editor-in-chief. Illustrated. Pp. xi + 292. Interscience Publishers, Inc. $4.50.

Fading Trails: The Story of Endangered American Wildlife. Illustrated. Pp. xv + 279. $3.00.

FUSON, REYNOLD C. and HAROLD R. SNYDER. *Organic Chemistry.* Pp. viii + 506. John Wiley and Sons, Inc. $3.50.

GARDNER, VICTOR R. *Basic Horticulture.* Illustrated. Pp. x + 441. Macmillan. $3.75.

Organic Reactions. ROGER ADAMS, editor-in-chief. Pp. vii + 391. John Wiley and Sons, Inc. $4.00.

Organic Syntheses. Edited by L. I. SMITH. Pp. v + 114. Chapman and Hall, Ltd., London: John Wiley and Sons, Inc., New York. $1.75.

THOMPSON, SIR D'ARCY WENTWORTH. *On Growth and Form.* Revised edition. Illustrated. Pp. 1116. Cambridge University Press, England: Macmillan, New York. $12.50.

War Medicine. A Symposium. Edited by WINFIELD SCOTT PUGH. Illustrated. Pp. 565. Philosophical Library, New York. $7.50.

SCIENCE NEWS

Science Service, Washington, D. C.

MEDICAL CARE OF THE FIGHTING FORCES OF THE UNITED STATES

SPLENDID provisions for the medical care of our armed forces have been made.

The medical corps of the Army and Navy have been trained and strengthened to meet the medical needs of our fighting forces in days to come. More than that, throughout the country, in universities, scientific research institutions, and research laboratories of commercial companies, a great organized effort is in process. Our medical officers are being equipped with the latest and most improved resources of medical science.

Discoveries made between the last war and this have lessened enormously the risks of fatalities and disablement from wounds. Treatment with sulfanilamide and other sulfonamide drugs has been shown to yield results which promise better than 50 per cent. reduction in mortality from wounds and wound infections compared with the last war.

At the present moment eight teams, each consisting of highly skilled surgeons and bacteriologists, are at work in hospitals in Boston, New York, Baltimore, New Orleans, Nashville, Detroit, and Akron, studying the best choice of these drugs, the best methods of their application, the best methods of supporting treatment. The cases which they study are derived from traffic accidents, accidents in industrial plants, chosen because of their similarity to those which are encountered in warfare. In eight other institutions, fundamental questions of infection and wound healing are being investigated by skilled laboratory personnel.

Another formidable menace to fighting men is the condition known as "shock." It may arise from wounds and loss of blood. Failure of the heart and circulation is its most prominent feature. It is treated by rest, heat, morphine and blood transfusions. In "shock," the blood vessels apparently lose their capacity of retaining the fluid of the blood within them, hence the necessity for an artificial replenishment of this fluid.

Salt solutions, injected into the blood vessels, leak out at once and are only momentarily effective. Whole human blood is effective but under field conditions is largely unobtainable. Stores of human blood plasma, either liquid or reduced to dry powder by special arts of desiccation, have been accumulated and are ready to be supplied to the armed forces in field, and the evacuation and general hospitals.

The most effective constituents of blood plasma in combatting shock are proteins. Of these the albumin is most important because it is present in largest amount and has the greatest capacity for holding the fluid in which it is dissolved within the blood vessels. The brilliant work of a group of investigators at Harvard has resulted in the development of methods by which the albumin of human blood plasma is separated in a state of high purity and high concentration and can, with a minimum of difficulty, be distributed to army surgeons.

Great work is being done by blood donor centers. Acquisition of supplies of human blood requires extensive organizations of citizens, physicians and technicians.

They make one think of the millions of gallons of beef blood which are being thrown away yearly in our slaughter houses. If beef albumin could be prepared in such form and so pure as to be harmless when injected into man, an unlimited supply of an essential therapeutic agent would be made available with infinite saving of money and human effort. Harvard investigators are now devoting intensive efforts toward this goal; the results thus far obtained give encouraging promise of success.

Airplane design has achieved incredible capacities for speed, altitude and maneuverability. These involve the subjection of our flying personnel to strains and stresses for which the human body seems never to have been designed.

Perhaps the most important task which confronts military medicine of today is that of learning how to equip the flyer with the means of protecting himself against the conditions to which the perfections of his plane subject him. He must be prepared to resist rapid changes of temperature, from tropical heat to most intense arctic cold; to rise quickly from sea level to heights five to seven miles up—heights at which the breathing of pure oxygen, unless under pressure, will not maintain life.

In dive-bombing, for example, he must be able to withstand the terrific strain of suddenly reversing the direction of flight at speeds of hundreds of miles an hour.

To such physical strains are added the mental and nervous tension of life and death combat in which his every sense must be alert.

Much has already been done in devising mechanical equipment to overcome these difficulties. More remains to be done. Guided by the studies of the Committee on Aviation Medicine, the Committee on Medical Research has arranged for the installation of elaborate equipment and the employment of physiologists, physicists and physicians in a dozen universities where these problems are being and will continue to be studied under conditions most favorable to success.

If victory in this war is to be achieved by air superiority, you may be certain that that superiority will depend upon the learning of the physiologist as well as upon the genius of the engineer.

These are only a few instances of the researches that our investigators are conducting. Search is under way for new and more effective means for the prevention and cure of malaria and other infectious diseases; of coping with possible gas poisonings; new drugs are being discovered and invented, some of which seem to give amazing promise. What will emerge from all this effort is not only increased capacity to fight this war but the acquisition of a body of scientific medical knowledge which cannot fail to be of permanent value to us all.—A. N. RICHARDS, *Chairman of the Committee on Medical Research, Office of Scientific Research and Development.*

EGG PRODUCTION

EXPERIMENTAL attempts to increase egg production from German hens by feeding them female sex hormone are described in a nearly year-old copy of the German journal, *Die Umschau*, which has been received in Washington, after lying no one knows where, since several months before the entry of the United States into the war. They are reported by an experimenter named Lothar Zirngiebl, whose address and connections are not given.

Herr Zirngiebl states that he was interested in trying the hormone when a notable decline in egg production, on the part of German hens generally, set in during the spring of 1941. He claims that one group of 14 hens brought its daily production from only one or two from the entire penful up to as many as eleven eggs a day. The weight of individual eggs also showed a notable increase.

However, results of this experiment can not be taken as conclusive. Aside from the small number of hens included in the experiments, the circumstances precluded the close supervision necessary for good scientific work. The hens did not belong to the experimenter; he had to persuade a not-too-cooperative owner to let him use his birds. Furthermore, there was no control group: there should have been an equal number of hens fed and treated in exactly the same way except for the addition of the hormone to their feed, for comparison. Without such control animals, biological experiments are not usually considered reliable.

Finally, there is that matter of the general decline in egg production. It may have been statistical rather than biological. After the first World War, German country people would tell an American visitor, after they got to know him well enough: "The blockade? Well, it was hard on folks in the cities, but here on the land we didn't fare too badly. They sent food requisitioners around, but there were ways of evading them. For instance, we ate eggs as soon as they were laid, and then told them our hens had stopped laying."

Perhaps something of the kind is going on again. Not even the Gestapo can keep a nose in every nest.—FRANK THONE.

POWDERED VEGETABLES

THE convenient small cans of strained vegetables for babies may be out for the duration, but mothers will not be forced themselves to cook and strain the baby's vegetables. Dried, powdered vegetables can be safely substituted for infant feeding, according to Dr. Reuel A. Benson, professor of pediatrics at the New York Medical College.

Convenience is not the only result expected from Dr. Benson's findings. Babies and small children in war-devastated regions are particularly in need of vegetables in easily digested form. Many more of them will be able to get these foods, because from eight to ten pounds of fresh vegetables are reduced to one pound by dehydration, with consequent saving in shipping space. That even two-day-old infants can be safely given the powdered, dried vegetables when suitably diluted with water, is announced in a report appearing in the *Archives of Pediatrics*.

Babies under four months of age are usually not given vegetables, even strained ones, because of the difficulty at that young age of swallowing solid foods. Dr. Benson does not recommend routine use of the powdered vegetables for very young infants. The fact that eighty-four newborn infants were able to take the dehydrated vegetables from the second to tenth day of life without harm shows, however, that they may be safely given to older babies. The powdered, dried vegetables were also given to thirty-four older infants and thirty-six older children without any trouble. The drying process does not appreciably lessen the nourishing value of the vegetables except for loss of anti-scurvy vitamin C.

The dried vegetables may be given in more concentrated form to counteract constipation in infants and children. Powdered vegetables may also be useful for allergic children, since the process may alter the protein content somewhat as the protein in evaporated milk is altered so that it causes less sensitivity than fluid milk.

SYNTHETIC RUBBER PLANTS

BY making steam do two jobs instead of one in the new synthetic rubber plants, electric power will be created, enough not only to run the entire plant and neighboring works but with some to spare which will be added to the regular public utility lines to help supply other war industries. This is the message given by F. H. Stohr, of the Westinghouse Electric and Manufacturing Company, which is making the turbine generators for this purpose.

Steam is plentiful about plants making butadiene and styrene for Buna S rubber, for it is needed in the chemical processes. By passing it first through a turbine and then through the chemical vats, all the necessary chemical work is done and a large amount of power is created as a "by-product." This power is in excess of the plant's needs, so that instead of taking precious power from the public utility lines, the plants will actually deliver power to them.

Three generators are now building, one of 35,000 kilowatts, two of 40,000 kilowatts. They take steam at 750 to 850 pounds per square inch and deliver it to the chemical line at 175 pounds. These generators and others to be built will be installed in the first four large synthetic rubber plants in this country, scheduled for completion in 1943. The output of all the Buna S plants at the end of 1943 is expected to be at the rate of 360,000 tons a year. With other plants to be built, synthetic rubber production is expected to approach the 1,000,000 ton-a-year rate by the end of 1944.

OILS FROM FRUIT PITS AND STONES

REMEMBER how you saved prune pits during the first World War? It looks now as if fruit pits and stones are going to be put to use again, though in a different way and for another purpose. What they wanted, in 1917–18, was the shells, for gas mask charcoal. They have plenty of that now.

What's wanted in this new war are the kernels within the pits, for the oil they contain. Such special oils as sweet almond oil, formerly imported, are on the list of war-shortages now, and the oils from apricot, peach and

cherry kernels resemble this rather closely. Prune-kernel oil would do nicely, too, but not many prunes are pitted at the processing plants.

It is not likely that housekeepers, restaurant owners and mess officers will be asked to save fruit pits this time. It is easier and far less expensive to go to the concentrated, quantity sources, the canneries and fruit-drying plants, where fruit pits have long been a useless waste, fit only for burning under the boilers. In normal times, the expense of cracking the pits and extracting and refining the oils has been too great, but with the price of oils much higher it seems worth while to install the necessary machinery.

Another source of vegetable oil that is recommended for industrial attention is the avocado. This fatty fruit has been steadily gaining in favor during recent decades, but as yet there is no really good, paying outlet for the disposal of culls and damaged fruits. Avocado oil is very much like olive oil in quality and flavor. Incidentally, despite the large quantities of olives raised in the West, domestic olive oil has never supplied more than five per cent. of the American market.

So-called rice bran oil has also received comparatively little attention. If ways can be found to prevent it from turning rancid, according to chemists of the Department of Agriculture, it can be used as a substitute for the now scarce vitamin-rich sardine oil in animal feeds.

MENTAL HYGIENE

PREVENTION of crime and delinquency, successful treatment of "problem" and backward school children, and the early detection and prevention of serious mental disorders have resulted from the pioneer work of the Suffolk County Health Department of New York, in setting up a mental hygiene program for rural areas. An encouraging report of its first year's work is given by Dr. George M. Lott, director of the Suffolk County Mental Hygiene Division, the first of its kind to be organized by a county health department. Dr. Lott's report appears in Public Health Reports of the U. S. Public Health Service.

In its work of prevention, the Suffolk County Mental Hygiene Clinic serves as a sort of classroom for parents and teachers, and a conference room, as well as a clinic. When a problem child is referred to the clinic, for instance, his teachers, his family doctor, the school nurse, and any one else interested in his welfare may all meet together and plan a cooperative program of treatment.

This method is not only valuable to insure cooperation among the various people and agencies involved in a case, but it provides a program of education in the principles of mental health. Several cases of "delinquent" boys are reported by Dr. Lott where such prompt cooperation and treatment undoubtedly saved them from reform school or jail. The importance of re-educating parents is illustrated in several cases where a normally intelligent child was failing in school.

ITEMS

AERIAL spread of two dangerous diseases, rabbit fever (tularemia) and Rocky Mountain spotted fever, is now suspected as a result of a discovery by Charles R. Joyce, Iowa State College entomologist, and Gaines W. Eddy, now of the U. S. Bureau of Entomology and Plant Quarantine. It was found that the nymphs and larvae of the common rabbit tick appeared on 29 kinds of birds examined at the Tama Indian Reservation. Although rabbit ticks rarely attach to man, and are therefore not directly responsible for transmitting the diseases, it is believed they spread the diseases among rabbits. From this reservoir of infection the diseases may spread naturally to other species of ticks, such as those which carry spotted fever. On one brown thrasher the entomologists found 495 young rabbit ticks, and 2,111 were removed from 24 of these common song birds. Hosts for the young rabbit ticks were found to include also the catbird, indigo bunting, wrens, towhee, robin, and other species of ground-feeding birds.

X-RAY machines that will stand up to hours on end of hard use under the severe conditions of military service and be perfectly safe, are assured by rigorous tests carried out by the National Bureau of Standards. The requirements are so severe that most machines fail to make the grade the first time they are tested. Then they must be remodeled and often the new model fails also. Sometimes models have been sent back half-a-dozen times before a machine was produced that could meet the strenuous military requirements. These machines are used to test the physical fitness of inductees, to examine injuries at army hospitals, to test materials in shipyards, airplane factories and other plants producing war materials.

ONE part castor oil to one part ethyl cellulose is the composition of the new plastic recently announced by the Hercules Powder Company to replace rubber in many of its uses. The new material has not the bounce of natural rubber, but there are many things for which rubber has been used which do not require this bounce—washers, gaskets, gloves, galoshes, garden hose, etc. It is estimated that sixty thousand pounds of rubber have been used in these ways annually, simply because it was cheap and plentiful. For all of them the new plastic is just as good, and in some ways better.

LATEST note on how to make rubber last as long as possible comes in an announcement, in the *Journal* of the Canadian Medical Association, of a new formula for a lubricating jelly for surgeons' rubber gloves, catheters and other rubber supplies. The formula was worked out by Professor W. E. MacKenzie, assistant professor of pharmacy in the Ontario College of Pharmacy, at the request of the Canadian Hospital Council. It calls for starch, distilled water, sodium lactate and mercuric oxycyanide. The new jelly is needed not only because of the rubber shortage but because of the increasing shortage of gums and glycerine used previously in non-greasy lubricating jellies for rubber supplies. It can be made in any hospital pharmacy for about 50 cents a pound and can be sterilized under steam pressure. It does not deteriorate on storage, nor does it harm either rubber or human tissues. It contains an anti-bacterial substance,

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// SCIENCE

VOL. 96 FRIDAY, SEPTEMBER 4, 1942 No. 2488

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

SCIENCE IN BRITAIN[1]

By Sir RICHARD GREGORY, Bt., F.R.S.

THE British Association for the Advancement of Science was founded in the year 1831. In the same year the world-renowned naturalist, Charles Darwin, left England in H.M.S. *Beagle* as a member of the famous expedition to the Pacific. Between 1831 and 1836 the expedition surveyed the South American coasts and adjacent islands, including the Galapagos Islands, and also the coasts of Australia and New Zealand. Darwin recorded that the voyage was the most important event in his life and it determined his whole career. The geological and other natural history notes made by him during the voyage, especially along South America, were the basis of most of his later works.

Exactly a century ago, Darwin prepared a short account of the facts observed by him which indicated relationships between different living things and suggested a common line of descent. Also, in the year 1842, was published his great work on "The Structure and Distribution of Coral Reefs," which gave the results of his own observations of coral atolls in the Pacific and Indian Oceans, and threw new light upon their structure. He suggested that cores should be obtained by borings of such reefs in order to discover how deep the coral rock extended below the limit of about thirty fathoms in which the coral organisms can live. The British Association was the first body to set

[1] From the report of the British Association for the Advancement of Science. This is the English text of a broadcast recently prepared by the president of the association for a series of talks on British science given in South American programs of the British Broadcasting Corporation in Spanish and Portuguese. It outlines the peacetime activities of the association, some of which are necessarily in abeyance now; it will therefore interest especially those who have come into contact with the association only during the war period.

such a project on foot, with the result that cores obtained at depths of more than a thousand feet were found to be built up of the remains of coral organisms living near the surface of the ocean.

One of the chief characteristics of the British Association is that of taking the initiative in promoting or undertaking scientific investigations of this kind. This applies also to other movements of national interest to which the association gives its authority and appeals for support. The acquisition and preservation of the house in the village of Downe, Kent, where Darwin lived for forty years and wrote his great work on "The Origin of Species," was the result of such an appeal made at an annual meeting of the association by the president, Sir Arthur Keith. Darwin took up his residence in the house exactly a century ago and died there in 1882. Through the generosity of a distinguished surgeon, Sir Buckston Browne, the house and grounds were purchased in 1927 and transferred to the possession of the British Association, with an endowment towards the maintenance as a national memorial. The chief rooms have in them furniture and objects used by Darwin himself and are decorated to reproduce the surroundings in which he worked. Charles Darwin's home at Downe has thus now become a place of pilgrimage similar in character and contents to the home of George Washington at Mount Vernon, Virginia, and similarly brings thousands of visitors to the shrine.

The British Association differs from other scientific societies in the fact that no professional rank or other technical qualification is required on the part of an applicant for admission to its membership. It is therefore, open not only to scientific students and investigators, but also to any member of the community interested in science. The association does not invade the field marked out by other scientific organizations, but provides common ground on which representatives of them all can meet to discuss methods and results of scientific research and foster public interest in them.

The objects for which the association was constituted are: to give a stronger impulse and a more systematic direction to scientific inquiry; to promote the intercourse of those who cultivate science in different parts of the British Empire with one another and with foreign philosophers; to obtain a more general attention for the objects of science and the removal of any disadvantages of a public kind which impede its progress.

The legislative body of this parliament of science is a general committee of about seven hundred members who have qualified to serve upon it by the publication of contributions to the advancement of science. This committee has similar functions to those of the British Parliament, and it similarly elects the council and officers to act as a cabinet governing the association's affairs.

The association meets annually as a corporate body, and the place of the meeting is decided by the general committee not less than two years in advance. Invitations to meet at particular places are sent to the association by municipal and other authorities; and there are usually several of these awaiting acceptance every year. The average number of membership tickets issued at an annual meeting is above two thousand, but at some meetings the number has been more than twice as great. At every annual meeting many local residents and others not professionally engaged on scientific work become members, and the expenses of the meeting are borne by the local authorities and their supporters. Since the foundation of the association in 1831 meetings have been held in most of the chief cities and towns of Great Britain, as well as in Ireland, Canada, South Africa, Australia and India.

There are now thirteen sections of the association, each with its own president and secretaries, and together they cover all branches of scientific knowledge. The sections meet separately for the consideration of their own special subjects, but two or more sections often meet jointly for the discussion of contributions of common interest. Communications to the various sections relate usually to the position of researches in which the authors are engaged and to problems arising out of them.

Results of new investigations are often announced at the annual meetings and are sometimes of great scientific interest. For example, it was at the annual meeting at Oxford in 1894 that Lord Rayleigh and Sir William Ramsay announced the discovery of a new gas, to which the name argon was given, in the earth's atmosphere. This gas is now widely used to increase the life and efficiency of electric bulb lamps. Another similar gas, neon, afterwards isolated from the air, is used in electric discharge tubes for advertisement and other purposes. The discovery of the existence of the electron, upon which the transmission and reception of electric waves used in all forms of radio communication depend, was announced by Sir Joseph Thomson at the annual meeting of the association in 1897. Five years earlier, Sir Oliver Lodge had given, at the annual meeting, the first demonstration that electric waves could be used for signalling in the Morse code, over a distance of sixty yards, through two internal and one external wall.

At every annual meeting, research committees are appointed to report upon particular subjects and problems of scientific importance. These reports, presented at following meetings, constitute the most influential part of the association's activities. The work of these committees is entirely voluntary, but small financial grants are made to cover essential expenses. Fully one half of the total receipts for membership tickets

for annual meetings have been devoted to scientific investigations by means of such grants, the total amount being about £1,000 a year. The association received no assistance from public funds, and possesses, therefore, the freedom of service highly cherished by most British scientists.

Through its research committees, the association has initiated many new scientific movements which have afterwards been maintained from public and other funds. The Kew Observatory, now under the British Meteorological Office, and one of the most renowned institutions in the world, was placed at the disposal of the association by Queen Victoria just a century ago. The government at that time had decided no longer to maintain the building as an observatory and museum, for which purposes it had been built by King George III. In spite of its slender financial resources, the responsibility for maintaining the observatory as a center of work in meteorology, terrestrial magnetism and electricity, and related subjects, was undertaken by a committee of the association, and the results of this decision have influenced the progress of geophysical knowledge everywhere. Between 1843 and 1872 the association made grants to the Kew Observatory amounting to £12,300, by far the largest total to any of its committees at any time in its history, and the whole of this amount was derived from the membership subscriptions at annual meetings.

Another example of work of international value is that carried out by British Association committees on electrical standards. Eighty years ago there were no generally recognized units or standards for the measurement of electrical resistance, current, electromotive force, quantity, capacity and similar values. The association undertook investigations of this subject over a long period of years, and the standards specified and constructed by its committees have become international, thus assisting trade and manufacture everywhere. In all the principal countries of the world the same electrical units and standards are adopted. The British Association was responsible for the institution of this uniform system.

Reports of this kind, with the inaugural address given annually by the president of the association, and the addresses delivered to the separate sections by their respective presidents, are now published in a quarterly review with the title, "The Advancement of Science," instead of a bulky annual volume. The current issue of this review includes all the papers read at the Conference on Science and World Order held in London in September of last year. The conference was arranged by the association's Divisions for the Social and International Relations of Science, and was attended by distinguished men of science and other citizens of more than twenty nationalities. This was the first occasion upon which representatives of science, administration and government met together to consider problems of the adjustment of progressive scientific knowledge to social action.

The division was established in 1938 to further the objective study of contacts of science with social conditions, and to promote the welfare of human communities by international understanding of them. It is empowered to hold meetings or conferences at any time with the view of attaining these objects; and it represents the response of the association for cooperation in the shaping of a social structure worthy of the powers which science has given to civilized communities. When General Smuts was president of the association at the Centenary Meeting in 1931, he pointed out in his presidential address on "The Scientific World-Picture of To-day" that "One of the greatest tasks before the human race will be to link up science with ethical values, and thus to remove dangers threatening our future." Every president since then has referred in his inaugural address to the social implications of science and the need for effective recognition of them. By the establishment of its new division the association has adapted itself to the needs of the times, and provided a new cooperative federation of thought and action on contacts of science with social and international affairs.

Every association for the advancement of science, constituted like the British Association and including not only scientific workers but also members of the community engaged in other pursuits, can take part in this development of its fields of activity. Freedom from any sort of political influence or domination is a characteristic of British scientific societies and is essential for the impartial study of social and international problems. Since the British Association was founded, similar bodies have come into existence in the United States, Australia, New Zealand, South Africa and other countries, and all of them possess the spirit of cooperation for the increase of knowledge and the service of mankind.

Meetings of the association outside Great Britain have always stimulated interest in science and its relationships to the community. There is nothing in the constitution of the association to prevent such meetings being held outside the British Commonwealth, or for delegates to be sent to a conference in any country. The expanded outlook represented in the new Division for the Social and International Relations of Science can give high public significance, as well as scientific authority, to such a meeting anywhere in the world.

CORRESPONDENCE IN REGARD TO THE CENSORSHIP OF SCIENTIFIC JOURNALS

LETTER FROM J. MCKEEN CATTELL, EDITOR OF SCIENCE, TO COLONEL W. PRESTON CORDERMAN, CHIEF POSTAL CENSOR, WRITTEN FROM LANCASTER, PENNSYLVANIA, JUNE 27, 1942

I SHALL be under obligations to you if you will give me some information concerning the censorship of scientific journals. I am and have been for forty-six years editor of SCIENCE, a weekly journal devoted to the advancement of science. It is the official organ of the American Association for the Advancement of Science, with over twenty-three thousand members, including nearly all those in the United States who are engaged in scientific research.

SCIENCE is made up each week on Tuesday, the copies are printed on Wednesday and Thursday, and are mailed on Thursday evening, the day of publication being Friday.

In accordance with instructions from your office, the pages of the issue for June 19 were sent to you on June 16, which was the earliest possible date. You returned the pages on June 19; they were received on June 20. It was necessary, of course, to print the journal before receiving the proofs from your office, and the copies were mailed as usual to subscribers in the United States and Canada on June 18. Copies for foreign countries were held pending your approval.

You have not censored any part of the editorial pages, but you have censored three notes printed in the supplement among the advertising pages. This is syndicated material, supplied to SCIENCE by Science Service, Washington, D. C., and had all been printed in other journals. Two of the erasures (one of three words) concern matters of health which the Advisory Committee on Scientific Publications of the National Research Council has decided should not be suppressed.

Now what are your instructions in regard to the copies for foreign subscribers? We can not possibly reprint the number with these unimportant omissions. SCIENCE, as you will note, goes to four hundred and sixty-one subscribers in sixty-one foreign countries. It is perhaps the most influential list of subscribers in foreign countries of any American magazine, going to libraries and leading scientific men. Shall we black out the pages that have been censored by your office before mailing the copies? This is possible, but by no means desirable. Shall we write to the subscribers in foreign countries stating that, owing to the censorship in this country, we are unable to mail SCIENCE to them for the duration of the war? Would it not be most unfortunate for us to make this admission? I receive regularly the daily *Times* from London and a number of weekly and monthly journals, including *Nature* (the field of which corresponds with SCIENCE) the *British Medical Journal*, the *Lancet* and others. There is no indication that these journals have been censored in England.

There is enclosed a copy of a letter which I have just written to the chairman of the Advisory Committee on Scientific Publications of the National Research Council, which acts for the Government. You will note from the concluding paragraph that in the war of 1917 the Surgeon General and the Secretary of War ruled that there should be no suppression of a life-saving discovery on the ground that the enemy could also make use of it.

I trust you will give this matter your personal attention, for the advancement of science is essential to national welfare and to the prosecution of the war.

LETTER FROM J. MCKEEN CATTELL TO PROFESSOR LUTHER P. EISENHART, NATIONAL RESEARCH COUNCIL, JUNE 25, 1942

On May 8, I addressed to each of the referees in the medical sciences, of whose appointment you had informed me, a letter which read:

> Professor Eisenhart, chairman of the advisory committee on scientific publications of the National Research Council, informs me, as editor of SCIENCE, that a committee to consider developments of consequence in the present war has been formed in the field of the medical sciences.
>
> You are the referee in . . . and I beg you to tell me what kind of articles should be submitted to you before publication. Is it planned to prevent the publication in scientific journals of information that may promote health or limit disease among the people in the countries with which we are at war?

I have now received answers from each of the ten referees. They agree that information should not be suppressed that may promote health or limit disease among the people in the countries with which we are at war. I take it for granted that this would include methods for checking the spread of typhus or more speedy healing of wounds.

Two of the referees make statements, however, that seem to be inconsistent with this policy, or, indeed, with the general tenor of their own letters. One of them writes that articles "directed to the treatment of gas casualties should all be submitted to the appropriate referee." Another writes, "Suppose you reviewed a paper containing material on a new sulfonamide which seemed to be completely non-toxic and much more effective in the control of infections than any

hitherto known. Such a paper would be reviewed to see whether the material in it should be kept confidential until the end of the war."

This latter referee would doubtless have delayed publication of an article on penicillin which was submitted by the author to the Committee on Medical Research of the Office of Scientific Research and Development. They requested him not to send it to SCIENCE, but four months later, after *Nature* had published articles on the subject, wrote to the author that he might print it. It seems to me that SCIENCE is as competent as *Nature* to decide what should or should not be printed.

You have appointed distinguished referees in the medical sciences, and I shall appreciate any advice that they are willing to give. I understand, however, that this is only advice and that there is no intention of using "*es ist verboten*" methods. Otherwise, I should need to know on what authority they are acting. Unless superseded by higher authority, SCIENCE will follow the decision of the Surgeon General and the Secretary of War in the war of 1917. This is given in a letter from Welch printed in the biography recently published by the Flexners. C. G. Bull had developed an antitoxin for Welch's gas bacillus which was being very destructive on the Western front. In June, 1917, Welch wrote:

> Gorgas is entirely opposed on general principles to withholding the publication of Bull's discoveries, but he wished me to lay the matter before the Secretary of War, so we both saw Secretary Baker. The Secretary took at once the humane view and said that we should not consider for a moment holding back such a life-saving discovery on the ground that the enemy could also make use of it. I was very glad that both the Secretary and the Surgeon General without any hesitation took this position.

LETTER FROM COLONEL W. PRESTON CORDERMAN TO J. MCKEEN CATTELL, JUNE 30, 1942

Thank you for submitting for our interested consideration problems troubling you concerning the censorship of scientific journals scheduled for export from the United States.

Your attention is directed to the fact that the proofs of your publication are examined by the Technical Data License Division of the Board of Economic Warfare. This Division, as a service to the Office of Censorship, examines technical and professional data which is to be exported from the United States. We fully understand your concern over the delay in the return of your proofs from that Division, and will do all we can to have them examined as quickly as possible.

The Technical Data License Division is authorized to order deletion or excision of any information which may be of use to the enemy. Examiners in the Division believe that the material marked for deletion in your June 19 issue would be of aid to the enemy. The reasoning of the examiners is set forth as follows:

1. The deletion of references to indium, relating to a newly discovered process to provide a safety lining for lead shaving cream and toothpaste tubes. They believe that this new discovery should be kept from the enemy, who, if they learned of it, could turn it to their use.

2. The article explaining the use of vitamin C in preventing heat cramps and heat prostration. It is believed that this information in the hands of our armed forces would give them an advantage over the enemy, particularly in desert warfare where heat prostration and heat cramps are common. If we know how to prevent such disorders and the enemy does not, we certainly have an advantage over our opponents.

3. The deletion of the words, "containing calcium polysulfide," from a story explaining use of this chemical in spraying walls of mines to prevent mercury poisoning. If the enemy is troubled with mercury poisoning in their mines, they could use to advantage a chemical of this nature, whereas, if they do not have this knowledge, their production might be affected and the advantage would be ours.

We are in accord with the ruling of the Technical Data License Division and, therefore, request that regulations covering the export of technical and scientific information be complied with. The June 19 issue of SCIENCE may be exported after excision of the objectionable portions which were marked on the proofs returned to you by the Technical Data License Division.

We do not advise that you write your foreign subscribers stating that, "owing to censorship in this country," you are unable to mail your magazine outside the United States, inasmuch as that is not a correct statement. Your magazine may be mailed to points outside the country so long as you comply with the regulations relating to their contents. As for the scientific journals printed in England, they probably are censored prior to publication, following the same procedure as that in force in the United States.

We are not familiar with any regulation promulgated after the beginning of this war, which makes blanket approval of the policy that there should be no suppression of a life-saving discovery on the ground that the enemy could also make use of it.

We were unsuccessful in attempting to contact Prof. Arthur B. Eisenhart, of the National Research Council, to whom you refer. We shall confer with Professor Eisenhart to determine the basis on which the Council issues regulations relating to the export of technical and scientific information.

Thank you for bringing these matters to our attention. Your patriotic cooperation in the future will be greatly appreciated.

Letter from J. McKeen Cattell to Colonel W. Preston Corderman, July 8, 1942

Please let me thank you for your courteous letter of June 27 in regard to the censorship of scientific publications. We need, however, further information.

The copies of Science for June 19 and 26 and July 3 have been mailed as usual to some 14,000 subscribers in the United States and Canada. 461 copies have been held for foreign subscribers, pending instructions from you.

The copy of June 19 was released by your censor after three minor elisions. These were all in the syndicated notes supplied by Science Service and had already been printed in many newspapers. They were all concerned with matters of health (one but three words in length) which should not have been censored by a competent authority; the censorship would probably not be upheld if an appeal were made to a higher authority. Please let me know to whom such an appeal should be made. Please also send me a copy of the executive order of December 19, No. 8988 under which your censorship is acting.

The number of Science for June 19 had been printed when your report was received; it is not feasible to print a new edition for foreign subscribers with these elisions. The cost would be large and it would be unethical for a journal to print one edition for the United States and one for foreign subscribers without an explanation of the situation.

No report has as yet been received from the censor on the page proofs of the issues of June 26 and July 3 and 10. It is impossible to delay the publication of a weekly journal; so as stated above, the copies for foreign subscribers are being held until instructions are received from you.

Foreign subscribers will doubtless complain of not receiving the copies of these numbers for which they have paid. Please inform us what should be written to them. I wish that you would consult the Department of State to learn what their attitude would be toward forbidding the sending to foreign nations, especially Mexico, Cuba and South America, of a journal such as Science.

Science has, of course, refrained from printing any material concerning improvements in explosives or poison gas or any other matter that might promote the efficiency of the armies of the enemy. But it will be a tragedy if American scientific journals are forbidden to publish information that might promote health or limit disease among the people of the countries with which we are at war. It has always been the fine tradition of the medical profession that a physician will do all he can to save lives, even of criminals. It would be appalling if in a war intended to promote freedom and international goodwill, the publication were prohibited of articles on evidence of medical knowledge.

To withhold publication of information that might lead to the promotion of health or the limitation of disease would be a betrayal of the ethics of medical men handed down from past generations. The government now needs 50,000 physicians for the Army. What would they think if it were known to them that such action had been taken; they would be ashamed to meet their colleagues of the allied nations. As I have told you, in the war of 1917 the Surgeon General and the Secretary of War ruled that "We should not consider for a moment holding back a life-saving discovery on the ground that the enemy could also make use of it."

Letter from J. McKeen Cattell to Colonel W. Preston Corderman, July 9, 1942

Since writing to you yesterday, July 8, we have received a notice from the censor releasing for mailing abroad the issue of Science for June 26. Copies were prepared for mailing in accordance with your instructions, but to-day, July 9, Mr. Kreider, superintendent of mails at Lancaster, decided after consultation that the copies of Science could not be accepted without open ends in accordance with your specifications, as in this form they would be first class mail. Copies that are now wrapped and stamped in the bindery must be taken from the wrappers and the wrappers sent to Washington for redemption of postage paid.

We trust that after my letters of June 27 and July 8, you will release for mailing the issue of June 19. I have received from Dr. Luther P. Eisenhart, chairman of the Advisory Committee on Scientific Publications of the National Research Council, acting for the Government, a letter dated June 2 in which he writes: "It is not the intent to withhold publication of advances in medical knowledge which would be of wide-spread value in the treatment of war injuries and the control and treatment of disease." This decision would, of course, permit the publication of the unimportant notes that you have censored in the issue of June 19.

You will note that we have conflicting instructions from government agencies, both in regard to what can be printed in Science and under what condition the copies can be mailed abroad. I trust that you will agree with me that national efficiency is seriously impaired under such circumstances.

Science, as you know, is a weekly journal of the highest standing, the property and official organ of the American Association for the Advancement of Science. It was established by Thomas Edison sixty years ago;

was later taken over by Graham Bell, and has had the cooperation of our leading men of science, whose work is so essential to the national welfare. They would not countenance publication of anything that was not in the interest of the nation. Are they not more competent to judge than any one in your office? I trust that you will give us permission to mail copies of SCIENCE without requiring censorship of each issue in your office. This causes delays and interference with the regular publication of a journal useful for national efficiency and welfare.

LETTER FROM MAJOR N. V. CARLSON, ACTING CHIEF POSTAL CENSOR, TO J. MCKEEN CATTELL, JULY 14, 1942

Your letter of July 8, 1942, has been referred to me for consideration and reply. Attached is a copy of Executive Order 8985, although in your letter you referred to the order number as being 8988. It is thought, however, that you had in mind the executive order establishing censorship.

Concerning your question as to possible appeal, it is assumed you are referring to a Board of Appeals which might supersede the action of the examiner of technical data. There is no such Appellate Board functioning. All professional and technical data material is reviewed by the Technical Data Division of the Board of Economic Warfare. Material other than technical data is reviewed by the Office of Censorship. The action taken by both of these agencies is final. However, we have no desire to be arbitrary in our censorship action and will be glad to discuss your problems with you at any time. There is no change in our position regarding the deletions which must be made before your publication is exported.

We have investigated the delay of which you complain in handling proofs of SCIENCE, and find from the Board of Economic Warfare, to which they were sent, that the June 26 issue was received on Saturday, July 4, approved on Monday, July 6, and mailed to you the following day. The July 3 issue also was received July 4, approved July 7, and mailed July 8. The July 10 issue was received July 8, but was not accompanied by an application for license, according to the Board of Economic Warfare.

The general question of precensorship of medical publications is being studied and we soon shall be able to provide a suggested code of practices which may be helpful in avoiding material which is objectionable by censorship standards. Any form of censorship is bound to be restrictive, but in the interest of the war effort this temporary expedient is necessary.

LETTER FROM MAJOR N. V. CARLSON TO J. MCKEEN CATTELL, JULY 14, 1942

While we appreciate the contribution your magazine is making in its field, we nevertheless are unable to grant your request that it be permitted to mail copies abroad without censorship. As stated in our letter of yesterday, in answer to your prior communication, wartime conditions require such examination.

I note that you quote Dr. Luther P. Eisenhart's letter of July 2 in which he stated, "In general, it is not the intent to withhold publication of advances in medical knowledge which would be of widespread value in the treatment of war injuries and the control and treatment of disease." Dr. Eisenhart also said, "Only in instances in which publication would result in military advantage to the enemy is the withholding of scientific papers from publication advisable." We agree with that premise as completely stated.

The National Research Council is a purely advisory organization insofar as scientific publications are concerned and, as you know, has experts available for your consultation and advice. The censorship function, however, does not fall within the field of the council, which I am sure does not agree with your interpretation that it is issuing "conflicting instructions" on material which may be exported.

Insofar as the question of post office regulations raised in your letter of July 8 is concerned, Postal Censorship requires no particular type of wrappers for your publication. The only requirement is that the technical data license be stamped prominently on the outside of the wrapper.

If the publication does not have a license, the copies will be returned to the sender.

EXECUTIVE ORDER
8985

ESTABLISHING THE OFFICE OF CENSORSHIP AND PRESCRIBING ITS FUNCTIONS AND DUTIES

By virtue of the authority vested in me by the Constitution and the statutes of the United States, and particularly by section 303, Title III of the act of December 18, 1941, Public Law 354, 77th Congress, 1st Session, and deeming that the public safety demands it, I hereby order as follows:

1. There is hereby established the Office of Censorship, at the head of which shall be a Director of Censorship. The Director of Censorship shall cause to be censored, in his absolute discretion, communications by mail, cable, radio, or other means of transmission passing between the United States and any foreign country or which may be carried by any vessel or other means of transportation touching at any port, place, or Territory of the United States and bound to or from any foreign country, in accordance with such rules and regulations as the President shall from time to time prescribe. The establishment of rules and regulations in addition to the provisions of this

order shall not be a condition to the exercise of the powers herein granted or the censorship by this order directed. The scope of this order shall include all foreign countries except such as may hereafter be expressly excluded by regulation.

2. There is hereby created a Censorship Policy Board, which shall consist of the Vice-President of the United States, the Secretary of the Treasury, the Secretary of War, the Attorney General, the Postmaster General, the Secretary of the Navy, the Director of the Office of Government Reports, and the Director of the Office of Facts and Figures. The Postmaster General shall act as Chairman of the Board. The Censorship Policy Board shall advise the Director of Censorship with respect to policy and the coordination and integration of the censorship herein directed.

3. The Director of Censorship shall establish a Censorship Operating Board, which shall consist of representatives of such departments and agencies of the Government as the Director shall specify. Each representative shall be designated by the head of the department or agency which he represents. The Censorship Operating Board shall, under the supervision of the Director, perform such duties with respect to operations as the Director shall determine.

4. The Director of Censorship is authorized to take all such measures as may be necessary or expedient to administer the powers hereby conferred, and, in addition to the utilization of existing personnel of any department or agency available therefor, to employ, or authorize the employment of, such additional personnel as he may deem requisite.

5. As used in this order the term "United States" shall be construed to include the Territories and possessions of the United States, including the Philippine Islands.

THE WHITE HOUSE,
DECEMBER 19, 1941

No. 8985

LETTER FROM J. MCKEEN CATTELL TO MAJOR N. V. CARLSON, JULY 17, 1942

Please let me acknowledge the receipt of your two letters, both dated July 14. You also sent me the executive order, for which I asked, establishing the Office of Censorship and prescribing its functions and powers. This executive order empowers the Office of Censorship to censor "communications by mail, cable, radio and other means of transmission passing between the United States and any foreign country." It also creates a censorship policy board consisting of the Vice President of the United States and other officers of the Government. It apparently does not refer in any way to the censorship of periodical publications. You tell me that action taken by your office is final and that there can be no appeal. Surely there can be an appeal to the Censorship Policy Board and also to the courts. It seems rather futile to refer you to the first article of the Bill of Rights, which provides that there shall be no suppression of freedom of the press. If the Constitution seems to be violated, there can be an appeal all the way to the Supreme Court of the United States.

I have, however, no wish to discuss matters that should be taken up by the American Association for the Advancement of Science, The American Medical Association, the Publishers' Association and other bodies, for your rulings concern not only SCIENCE but all publications of the country.

I must, however, attend to the problems that you raise concerning SCIENCE. Your office, in instructions dated March 18, read "After the license is granted, each copy must be wrapped without open ends." Now on July 14 you write: "Postal censorship requires no particular type of wrappers for your publication." How do you reconcile these conflicting instructions? If a number of SCIENCE has not been censored, which has happened just once, you send us a license number to send 461 copies to foreign subscribers, each of which must be signed individually. What is to be done about other copies that should be sent abroad? We must fill special orders, supply copies lost in the mails, and we always send a number of copies to contributors, many of whom reside abroad. How can these copies be sent?

The pages of the issue of SCIENCE for July 3 were sent to you in duplicate on June 30. You state that they were received on July 4, approved on July 7 and mailed on July 8. Every issue of SCIENCE has been published on Fridays without exception, so far as I remember, during the more than forty-six years that I have edited the journal. You surely could not have wanted us to hold up the printing of SCIENCE for some fourteen thousand subscribers in the United States until the pages had been censored after a delay of ten days. When we received the censored sheets, they contained exactly one elision as follows:

> A new sulfa drug has been announced by Sharp and Dohme. It is succinyl sulfathiazidine, which the firm has released under the trade name, Sulfasuzidine. Studies in the laboratory and with patients have shown that it is active against dysentery and other intestinal tract germs and may therefore be effective in preventing infection following operations within the abdomen. It is also claimed that it cures carriers of dysentery germs.

This note was printed with other syndicated material sent to us by Science Service, which had been distributed to newspapers from Maine to California. It should not, in any case, have been censored, for it referred to an alleged advance in medical science which

you yourself write should not be suppressed "unless it would result in military advantage to the enemy." Now what shall we do with the 461 copies of SCIENCE that we are holding for foreign subscribers? Please answer this question definitely. Please also tell me what should be written to foreign subscribers who have not received their copies of SCIENCE on account of the censorship.

I shall take it for granted, unless you write to me to the contrary, that our correspondence may be shown to others and published in SCIENCE, should that seem to me to be in the interest of science and the nation.

LETTER FROM COLONEL W. PRESTON CORDERMAN TO J. MCKEEN CATTELL, JULY 21, 1942

In order to avoid any further confusion concerning the jurisdiction of Postal Censorship, we reiterate that Postal Censorship is not concerned with publications distributed within the continental limits of the United States. However, Postal Censorship is charged with the responsibility of examining publications and communications which are placed in the international mails for export, and the suppression of any material which would be of aid to the enemy and injurious to the welfare of the United States and Allied Nations.

Thus, we believe you will understand, the duties of Postal Censorship include safeguarding scientific and technical information which would be of military value to the enemy. It was the considered opinion of the examiners of the Technical Data License Division of the Board of Economic Warfare that the articles ordered deleted from your publication would be of military value to the enemy. Your publication received an export license with a provision that the objectionable material be deleted before the magazines were placed in the mails for export.

Again we state that Postal Censorship has no objection to the mailing of SCIENCE to foreign subscribers provided the war-time restrictions of censorship are complied with and that excisions of objectionable material noted in the licenses are made prior to international mailing. This is not an arbitrary rule applied only to SCIENCE, but is a principle that is adhered to by all publications containing technical, scientific and professional data, which are exported.

Our letter of July 14 informed you that for your magazine no "special type of wrapper" need be used. The only requirement in this respect is that the Technical Data License be placed in a prominent position on the front of the wrappers.

You may send the 461 copies of your publication to foreign subscribers provided objectionable material is deleted and the export license is placed on the wrappers. Copies of every issue of your publication may be mailed to foreign subscribers and contributors provided those issues are licensed and provisions of the license are complied with.

Your cooperation in aiding the purpose of censorship will be greatly appreciated. Naturally, we have no objection to your publication of our correspondence if you feel a useful purpose will be served by your so doing.

OBITUARY

WADE HAMPTON BROWN

WADE HAMPTON BROWN died at Rice Lake, Wisconsin, on August 4, 1942. His sudden death terminated a career of original thought and pioneer research of such caliber and scope as to render premature any present attempt to appreciate or evaluate his position in American medicine.

Dr. Brown was born in Sparta, Georgia, on October 18, 1878. He received his bachelor's degree from the University of Nashville in 1899 and his degree in medicine from Johns Hopkins in 1907. He instructed in pathology at the University of Virginia and at the University of Wisconsin until 1911, when he was made professor of pathology at the University of North Carolina. His interest in education began in premedical years as a teacher in the rural schools of Texas and was maintained throughout his life, but an opportunity to devote full time to research offered broader fields for his abilities and in 1913 he began his long association with the Rockefeller Institute for Medical Research. He was made a full member of the scientific staff in 1922 and continued active research, first in New York and later in Princeton, throughout the remainder of his life.

His early work was concerned with pathological pigmentations and it is a commentary on his ability that his original observations still hold despite the introduction of new and refined techniques. His research in experimental syphilis, the chemotherapy of trypanosome and spirochete infections and cancer were of profound influence. He contributed much to the knowledge of the biology of syphilis, played a dominant role in the elaboration of tryparsamide and discovered and successfully transplanted the rabbit tumor which now bears his name. However, the greater and more fundamental significance of this work is referable to coincident observations on animal behavior which prompted his major undertaking, the study of constitution and environment in relation to disease.

With the exception of preliminary observations reported in a Harvey Lecture in 1929, the results of

this study remain unpublished and the work is known only by his intimate laboratory associates. It was Dr. Brown's plan to start the organization and publication of the material this fall, and his untimely death deprives medicine of basic contributions. It is essential that some arrangement be made to organize and report the work, for its implications from the point of view of human constitution and the inheritance of disease types are revolutionary and demand a reconsideration of fundamental tenets in genetics and pathology.

Dr. Brown's interest was focused on the relationship borne by constitutional factors to disease susceptibility, and his natural abilities combined with great patience and an unlimited capacity for work rendered him particularly fit to undertake the problem. His observational powers were developed to an unusual degree and his eyes and fingertips sufficed for laboratory equipment. The last thirteen years were spent in intimate contact with his animals and he was able to tell accurately the remote ancestry of any particular rabbit from its physical conformation and habits. Moreover, in the majority of cases, he could foretell the ultimate fate of an animal on a basis of past history and pedigree. His patience exceeded the patience of Job, and the constitutional project was undertaken with the full knowledge that several generations of research workers would be required to finish the experiments he began. His capacity for work was also proverbial. His day began at 9 and rarely terminated before midnight. No task was too arduous for him if a grain of knowledge could be extracted from its performance. He had great sympathy for his technicians and helpers but hesitated to relinquish any phase of the work, however menial, for fear that essential data should be misjudged or lost through careless observation.

He possessed a broad sense of humor and a ready wit and his vast knowledge of public as well as of scientific affairs made him a brilliant conversationalist. A remarkable ability to organize and present a complex subject without forewarning or to clarify a confounded situation with a concise and penetrating analysis made his discussions and opinions sought after and remembered. His advice and time were always at the disposal of any one in need and his concern was not altered by the status or problem of the petitioner.

Dr. Brown was a gentleman in an almost forgotten sense of the word. His old-fashioned courtesy, consideration and tolerance, his great interest in everything and everybody and his unfailing friendliness set him apart, and his memory will be inspiration and refreshment to all who knew him.

HARRY S. N. GREENE

DEATHS AND MEMORIALS

DR. STEPHEN WALTER RANSON, professor of neurology and director of the Neurological Institute of the Medical School of Northwestern University, died on August 30 at the age of sixty-two years.

MARCUS STULTS FARR, associate professor emeritus of geology and paleontology of Princeton University, died on August 27 at the age of seventy-two years. He had been a member of the faculty for forty years.

DR. HOWARD CHESTER PETERS, since 1937 instructor in the department of physiology of the University of Tennessee, died on July 13 at the age of thirty-three years.

THE Lake County, Indiana, Medical Society has established the Oberlin Award in memory of the late Dr. Thomas W. Oberlin, of Hammond, one of its charter members. It will be presented each year to a Lake County citizen or institution making the greatest contribution to the health of the people of Lake County. The award consists of a plaque with the following inscription: "Presented by the Lake County Medical Society in recognition of significant contributions to the health and consequent welfare, security and happiness of the people of Lake County."

ACCORDING to the *Journal* of the American Medical Association, a tablet was unveiled at St. Anthony, Newfoundland, on August 4, to commemorate the fiftieth anniversary of the landing of the late Dr. Wilfred Grenfell on the coast of Labrador. Sir Wilfred established the mission in Labrador in 1892. Since his death on October 9, 1940, the activities of the mission have been carried on under the direction of Dr. Charles S. Curtis, St. Anthony. During the fifty years of Sir Wilfred's missionary work five hospitals have been established there, five nursing stations, two boarding schools, one day school and children's home, social services to improve the lot of the coast people, two hospital ships and a supply ship. The inscription on the new tablet reads "In gratitude to God for the Labrador Doctor."

SCIENTIFIC EVENTS

MILITARY TRAINING AT THE UNIVERSITY OF MICHIGAN

TRAINING leading to an officer's commission in the Navy or Army is available at the University of Michigan to physically fit male students through the Naval Reserve Officers' Training Corps and the Army Reserve Officers' Training Corps.

Enrolment in either of the R.O.T.C. programs is on

a voluntary basis, limited by the quotas fixed for the university by the War and Navy Departments. The Naval R.O.T.C. unit, which is starting its third year, has a quota of 250 students, while the Army R.O.T.C., which has been in existence since 1919, can accept 1,100 for basic training and 370 for advanced training.

Instruction provided by the two programs is designed to promote qualities of leadership as well as to impart essential information in regard to military and naval affairs. Both units are an integral part of the university, and academic credit is given to students taking the work. The Navy and Army officers assigned to duty at the university are listed as members of the faculty.

The Naval R.O.T.C. unit, known as the department of naval science and tactics, is under the direction of Captain R. E. Cassidy. Freshmen are admitted only at the start of the fall term in October. A physical examination, similar to that given at the Annapolis Naval Academy, must be passed. A general intelligence test also is given to aid the Naval R.O.T.C. officers in selecting the most promising freshmen from those who make application for admittance. Qualities of character, scholastic standing, age, potential qualities of aptitude, force, honesty, integrity, leadership and loyalty also are considered.

The course of training given by the Naval R.O.T.C. provides the student with a knowledge of seamanship, ordnance, gunnery, engineering, electricity, communications, military law and navigation. Uniforms are provided by the Government and certain compensation is paid to students during the last two years of the course. Enlistment in a special section of the Navy's V-1 program brings exemption from selective service for members of the Naval R.O.T.C.

Successful completion of a four-year course and one sea cruise of approximately four weeks on a naval vessel will qualify the student for a commission as ensign, United States Naval Reserve, or as second lieutenant, United States Marine Corps, provided he also receives a degree from the university.

The Army R.O.T.C., known as the Department of Military Science and Tactics, is under the direction of Colonel W. A. Ganoe. Any physically fit student is eligible to enroll for a basic period of training, covering four terms. An advanced course of training, covering another four terms of work, is limited to the most promising students who successfully complete the basic training. Enrolments in the basic course are accepted at the beginning of any regular term. The Government bears all the expense of uniforms and pays the students who qualify for the advanced course approximately $200. Training is provided in infantry, ordnance departments, signal corps, corps of engineers, medical corps and quartermaster corps, with students receiving instruction appropriate to the unit in which they specialize.

Members of the advanced course of Army R.O.T.C. are exempt from selective service. Students taking the basic training may join the Army Enlisted Reserve Corps and thus be permitted to continue the joint project of completing their education and seeking a commission in the Army.

Successful completion of both the basic and advanced training plus a tour of duty at one of the Army's service schools qualifies the student for a commission as a second lieutenant in the Officer Reserve Corps.

CIVIL SERVICE EXAMINATIONS FOR JUNIOR METALLURGISTS

The U. S. Civil Service Commission has issued the following statement:

Increasing numbers of scientifically and technically trained men and women will be required for the war effort this year and next. Junior metallurgists are urgently needed to conduct investigative, developmental or production work in various branches of metallurgy; to assist in the design, construction, installation and operation of metallurgical equipment; or to perform metallurgical work in the recovery or fabrication of metals.

The U. S. Civil Service Commission is recruiting junior metallurgists under a new announcement (No. 254) for which the qualifications are: (1) completion of a four-year college course in metallurgy or metallurgical engineering or (2) completion of a 4-year course in chemistry, geology, physics or engineering, supplemented by (a) one year of paid experience in metallurgy (college teaching in metallurgy is acceptable) or (b) 15 semester hours in metallurgy or metallurgical engineering or (c) completion of two War Training Courses in metallurgy.

There is provision for the acceptance of applications from college senior or graduate students who expect to complete the required courses within six months after filing applications.

In addition to the positions which pay $2,000 a year, there are a large number of vacancies in sub-professional positions at $1,800 and $1,620 a year. Applications will be accepted until the needs of the service have been met. There is no maximum age limit. No written test is required. Persons rated eligible as junior metallurgists under examination announcement No. 210 need not apply under the new announcement. Consult announcement No. 238 for information on higher grade positions.

Announcements and application forms may be obtained at any first- or second-class post office or from the Civil Service Commission, Washington, D. C.

COMMITTEE ON THE LOCATION OF NEW AND RARE INSTRUMENTS

Requests have been received by the Committee on the Location of New and Rare Instruments for instruments from research workers who urgently need them.

If any reader of SCIENCE has such an instrument available to lend, lease or sell he is requested to write the undersigned.

INSTRUMENTS SOUGHT

Microammeters and electrical meters generally.
Ultra-violet microscope.
Zeiss Optimeter (for measuring fine wires to 0.00001").
Two-circle Reflecting Goniometer (Goldschmidt).
Electro-Encephalograph (3 channel).
Warburg Apparatus.

The following instruments are offered for use by others and inquiries for them are invited:

INSTRUMENTS OFFERED

Zeiss-Pulfrich Refractometer.
Hunter Reflectometer (Infra red reflectance).
Coleman Spectrophotometer (complete).
Capacigraph (*Jour. of Laboratory and Clinical Medicine*, 22, 1279, 1937; 25, 175, 1939).
Mechanical Ink Writing Recorder (*Am. Jour. Obstetrics and Gynecology*, 40, 330, 1940).
Grating Spectrograph: Focal length 2 meters
Dispersion 8 Å/mm, 1st order.
Grating Spectrograph: Focal length 8 meters
Dispersion ¼ Å/mm. 4th order.

The Committee on Location of New and Rare Instruments of the Division of Chemistry and Chemical Technology, National Research Council, will be glad to put inquirers in appropriate contact with those who can supply their needs. In so doing it assumes no responsibility, and owners of instruments must make their own arrangements with prospective users. Correspondence should be addressed to D. H. Killeffer, 60 East 42nd Street, New York, N. Y.

PROGRESS ON THE CONSTRUCTION OF A HUNDRED MILLION VOLT ELECTRON ACCELERATOR

IN response to a request of the editor of SCIENCE, Dr. W. D. Coolidge has sent the following statement in regard to the hundred-million-volt electron accelerator developed in the research laboratory of the General Electric Company at Schenectady, N. Y.:

Because of the demonstrated value of high voltage x-rays in the present war activity, the members of The National Inventors Council, at their meeting in Schenectady on August 18 and 19, were shown the status of the work of the General Electric Research Laboratory on the construction of a large induction electron accelerator based on the pioneer work of Dr. Kerst, of the University of Illinois.

This machine will be quite similar to the twenty million volt accelerator which was built in this laboratory with Dr. Kerst's help and has been loaned by the General Electric Company to Dr. Kerst and the University of Illinois. The new accelerator is designed for a hundred million volts and has, because of its size, presented many new engineering problems.

At the present time the special building to house it is completed and so are the magnet coils and the 24,000 KVA capacitor for their supply circuit. Much of the work on the 125-ton laminated steel core is finished and all the materials except the glass parts for the six-foot toroidal vacuum tube have been received. It is hoped that the device may be brought into operation this year or early next.

As it should make available x-rays and high velocity electrons corresponding to voltages up to a hundred million, it promises to be a very useful research tool.

So far as its immediate interest in connection with the war effort is concerned, the device will make it possible to determine the potentialities in the industrial radiographic field of x-rays produced by such electron energies as it can generate. Whether the electron current in the tube and hence the x-ray intensity producible by such a device can be large enough to make it a practical radiographic tool remains to be seen.

PRESENTATION TO THE ROYAL SOCIETY

AT a meeting of the Royal Society on July 16, a gold snuff-box, once the property of Charles Blacker Vignoles, F.R.S. (1793–1875), was presented to the society by his grandsons, Mr. E. B. Vignoles and Lieutenant-Colonel W. A. Vignoles.

Mr. E. B. Vignoles, in making the presentation, referred to the fact that in 1841 C. B. Vignoles presented to the Royal Society a fine portrait of Sir Isaac Newton, which had come to him as the result of a connection between his mother's family and that of Sir Isaac.

Continuing, Mr. Vignoles said that his grandfather, who was of Huguenot descent, came of a long line of soldiers and that he was an orphan and a prisoner in French hands at the age of thirteen months. He was educated by his maternal grandfather, Dr. Charles Hutton, F.R.S., the mathematician, the author of "Hutton's Logarithms," in the preparation of which Vignoles assisted. As a young man he served for a time in the Army, taking part in the disastrous attack on Bergen-op-Zoom in 1814.

Following the peace after Waterloo, he went to America, where he was engaged on survey work in South Carolina and Florida, then very little known. Returning to England in 1823 he was soon engaged in railway engineering, almost his first work being the first survey for the proposed Liverpool and Manchester Railway.

In the course of a long career he carried out important work at home and abroad as a railway and civil engineer, including the great suspension bridge over the Dnieper at Kieff and a railway through the Cantabrian Pyrenees from Bilbao to Tudela, which with its sharp curves and bold moving of a river, struck a

new note in railway engineering. The "Vignoles Rail," the flat-bottomed rail of his design still used all over the world, keeps his name familiar to railway engineers.

The snuff-box, now presented to the society, was given to Vignoles by the King of Wurtemburg, in 1844, as a mark of his esteem, after Vignoles had advised the King on the plans prepared by the King's ministers and engineers for the railways of the state. The snuff-box is of solid gold with a portrait of the King set in diamonds on the lid.

Vignoles was elected a member of the Royal Society in 1855 and was president of the Institution of Civil Engineers in 1870–71.

SCIENTIFIC NOTES AND NEWS

THE Medal of the Society of Chemical Industry of Canada has been awarded to R. A. Witherspoon for achievements in the electrochemical field with Shawinigan Chemicals Limited.

DR. MASON CAMPBELL, formerly professor of dairy production at the University of Vermont, later production manager and director of the Walker-Gordon Laboratories of New England, has been named dean of the Rhode Island College of Agriculture and director of the Rhode Island Agricultural Experiment Station.

AT the recent meeting of the corporation of the Woods Hole Marine Biological Laboratory, Donald M. Brodie was selected to replace Mr. Riggs as treasurer. Dr. O. C. Glaser succeeds Dr. Philip B. Armstrong as clerk of the corporation. Two trustees, Dr. S. O. Mast and Dr. Albert P. Mathews, having passed the age of seventy years, were elected to the emeritus class. They were succeeded by Dr. Eric G. Ball, of the Harvard Medical School, and Dr. Eugene F. DuBois, of the Cornell University Medical College. Dr. O. C. Glaser and Dr. C. W. Metz have been appointed members of the executive committee of the board of trustees. They succeed Dr. P. B. Armstrong and Dr. W. C. Allee.

DR. DONALD MACGILLAVRY, JR., of the University of Amsterdam and Columbia University, who has also been research fellow at the University of Cambridge, England, has been appointed instructor in organic and analytical chemistry in the University of Pittsburgh; Dr. Glen William Kilmer, post-doctorate fellow in biochemistry at the Cornell University Medical College, has been appointed instructor in organic chemistry.

DR. WILLIAM B. WALLACE, fellow in general surgery at the Mayo Clinic, has been appointed clinical instructor in surgery at the Stanford University School of Medicine in San Francisco.

AT Yale University, Austin H. Riesen, in psychobiology; Jacob B. Fishman, in pharmacology, and Harold Lamport, in physiology, have been promoted to assistant professorships. Albert K. Kurtz, statistician, editor of *Psychometrika;* Ralph P. Wolfe and Paul S. Burnham have been appointed to assistant professorships in the department of psychology.

DR. H. BRUCE COLLIER has been appointed assistant professor of biochemistry at Dalhousie University, Halifax. He was formerly biochemist at the Institute of Parasitology of McGill University. He takes the place of Dr. R. D. H. Heard, who has become assistant professor of biochemistry at McGill University. Dr. Karl M. Wilbur, instructor in the department of zoology at the Ohio State University, is taking the place of Dr. Hugh Davson, who is on leave of absence in England for the duration of the war, as assistant professor in the department of physiology.

AT the University of London, Dr. F. G. Young has been appointed to the university chair of biochemistry tenable at St. Thomas's Hospital Medical School; B. W. Windeyer has been appointed to the university chair of radiology tenable at Middlesex Hospital Medical School, and Dr. Alexander Lawson has been appointed to the university readership in organic chemistry tenable at the London School of Medicine for Women.

ACCORDING to *Chemical and Engineering News,* Alamjit D. Singh, a member of the department of experimental engineering of the University of Illinois, has been appointed associate chemical engineer at the Armour Research Foundation, Chicago. He is also technical adviser on chemical obscuration in civil areas for the organization on techniques of the Chicago Office of Civilian Defense.

DR. CHARLES H. BEHRE, JR., professor of economic geology at Columbia University, has joined the staff of the U. S. Geological Survey for the duration of the war.

DR. R. W. HUSBAND, of the department of psychology of the Pennsylvania State College, has joined the Research Division of the Industrial Relations Department of the Carnegie-Illinois Steel Corporation.

DR. CLARENCE W. SONDERN, Kansas City, and Dr. Willard M. Hoehn, formerly of Rochester, Minn., have been appointed directors of the newly established research chemicals division of the Laboratories of George A. Breon and Company, Kansas City, Mo. Synthetic organic chemicals, including bile acids, hormones and vitamins, will be prepared at the laboratory.

DR. FREDERICK W. SULLIVAN, JR., director of research of the Barrett Division of the Allied Chemical and Dye Corporation, has been appointed technical director of the Institute of Gas Technology, Chicago, which is affiliated with the Illinois Institute of Technology. He will have supervision of all research work. The Gas Institute is the only institution in the country where students may work for graduate degrees in gas technology. It was founded with four principal objectives: the training of personnel for the gas industry, the prosecution of fundamental research in gas technology, the collection and dissemination of scientific information and the conduct of applied research investigations on specific industrial problems.

DR. F. EBERSON has resigned as medical and research director of the National Drug Company, Philadelphia, to become pathologist and chief of laboratory service of the U. S. Veterans Administration Facility, Pittsburgh, Pennsylvania.

E. ROSS HENNINGER, of Haworth, N. J., who formerly edited technical publications for the American Institute of Electrical Engineers, has been nominated by President Roosevelt to be liaison officer of the Army Specialist Corps, Washington, with the rank of lieutenant-colonel.

DR. SHARAT K. ROY, curator of geology at Field Museum of Natural History, has been commissioned a captain in the U. S. Army. Rupert L. Wenzel, assistant curator of insects, has also left to accept an appointment as first lieutenant in the Sanitary Corps of the army.

THE Medical Library Association held its forty-fourth annual meeting in New Orleans, on May 7, 8 and 9. Headquarters were at the Jung Hotel and the sessions met in the auditorium of the New Hutchinson Memorial of the School of Medicine of Tulane University. Officers elected for the coming year are: Mary Louise Marshall, Tulane, *President;* Dr. John F. Fulton, Yale, *Vice-president;* Frida Pliefke, Mayo Clinic, *Secretary;* Bertha B. Hallam, Oregon, *Treasurer.* The program featured a Symposium on Tropical Medicine, Medicine in the South and the Medical Library, in the War program. Selection of the place for the 1943 meeting has not yet been made.

THE American Foundation for Tropical Medicine has announced the establishment of two paid fellowships at the Graduate School of Tropical Medicine of Tulane University of Louisiana. They have been made possible by the Winthrop Chemical Company, Inc., Winthrop Products, Inc., and the Lambert Pharmacal Company of St. Louis. These fellowships, which will be known as the Winthrop Fellowship and the Lambert Pharmacal Company of St. Louis, Mo., Fellowship, have been established to provide graduate training in tropical medicine for young physicians who are citizens of the United States. Applications should be addressed to the dean of graduate studies, Tulane University, New Orleans.

BEGINNING with Volume 28, Number 1, July, 1942, of the *American Midland Naturalist,* the following editors will review papers in vertebrate zoology: Dr. Karl P. Schmidt, Field Museum of Natural History, Chicago, papers in ichthyology and herpetology; Dr. Jean M. Linsdale, Hastings Reservation, Jamesburg Route, Monterey, Calif., papers on ornithology; Dr. Remington Kellogg, U.S. National Museum, papers in mammalogy.

FOR the second time, Cleveland Health Museum has received a grant from the Thomas H. White Trust Fund, in the amount of $1,100. This grant has been made to establish at the museum a permanent exhibit on nutrition and health. It is planned to open the exhibit in the early part of January, 1943.

THE Lewis Cass Ledyard, Jr., Fellowship of the Society of the New York Hospital was established in 1939 by a gift from Mrs. Ruth E. Ledyard, in memory of her late husband, Lewis Cass Ledyard, Jr., a governor of the New York Hospital. The income, amounting to approximately $4,000 annually, will be awarded to an investigator in the fields of medicine and surgery, or in any closely related field. This amount will be applied as follows: $3,000 as a stipend and, approximately, $1,000 for supplies or expenses of the research. In making the award, preference will be given to younger applicants who are graduates in medicine and who have demonstrated fitness to carry on original research of a high order. Applications for the year 1942–43 should be in the hands of the committee by December 15. It is expected that the award will be made by March 15, 1943. They should be addressed to: The Committee of the Lewis Cass Ledyard, Jr., Fellowship, The Society of the New York Hospital, 525 East 68th Street, New York, N. Y.

DR. CHARLES F. KETTERING, chairman of the National Inventors Council, a government agency under the Department of Commerce, on the occasion of the meeting of the council at the General Electric Company, announced that Americans, many of them non-professionals, have submitted to date 91,823 suggestions which they believe will help the Army and Navy in winning the war. In a two-day meeting of the council, the most recent and promising of these inventions were discussed and evaluated preliminary to making them available to the armed services. Ideas have been welcomed from amateurs because their suggestions in many cases prove fruitful and of practical use. Often

500 to 1,000 inventive ideas are received in a day at the Washington offices of the National Inventors Council.

THE establishment of a combined engineering and chemistry curriculum leading to the degree of master of science in chemical engineering at the University of California has been announced. The course is planned to give students a well-balanced training in both fields. Several departments, including chemistry, metallurgy, mechanical engineering, mining engineering and petroleum engineering, will cooperate in training graduate students for the new degree.

THE University of Pittsburgh will offer a course in "Military Chemistry and Chemical Agents" each trimester beginning on September 28. It will be based on "Technical Manual 3-215" of the War Department and will cover all the fundamentals and principles which are required by the manual. Two fully illustrated lectures will be given weekly by Dr. A. L. Robinson, of the department of chemistry. The purpose of the course is to train prospective registrants for military service.

THE Polytechnic Institute of Brooklyn plans a course in the fall of 1942-1943 in the reading of chemical Russian. This course will be given on Tuesday evenings throughout the year. It is designed to give a mastery of the grammatical principles and the vocabulary necessary for the translation of technical articles from Russian reference books and periodicals. Registrants need not have had previous experience with the Russian language, but must have studied some other modern foreign language. The work will involve supervised study and translation from chemical journals. Dr. Karl Steik, a consulting chemist, is in charge. Information may be obtained from Professor Raymond E. Kirk, of the department of chemistry.

IT is reported in the *Journal* of the American Medical Association that an agreement between the Southwestern Medical Foundation and Baylor University to set up a medical center in Dallas was approved at a special meeting of the executive board of the Baptist General Convention on July 7. The project has been under consideration for eight months. Under a ninety-nine year contract the medical and dental schools of the university will be moved, as soon as buildings are provided, to a 35-acre tract along Hines Boulevard and including Parkland Hospital. Under the contract one million dollars will be expended by the foundation for buildings for medical teaching, construction to start within a period of not less than two years after removal of priority restrictions. Parkland Hospital will be enlarged and become an integral part of the center, its facilities to be used in connection with the medical and dental colleges. The site for the center is within a few blocks of a large group of children's hospitals, including the Children's Hospital of Texas, the Scottish Rite Hospital for Crippled Children, Hope Cottage, Bradford Memorial Hospital for Babies and Freeman Memorial Clinic. The agreement places the two schools under the control of a joint board including three members from the foundation and two from Baylor. The university, which has been under supervision of the executive board of the Baptist General Convention, will be conducted on a non-sectarian basis. Development of the medical center will be in cooperation with the city-county hospital board administering Parkland Hospital, where the first aim of the medical foundation will be to improve clinical facilities. A dispensary will be the first unit in the new construction program. In addition to providing the buildings, the foundation will also furnish money for teaching. The medical school will continue to receive income from endowment, but Baylor University will retain the endowment fund. All student fees will go into the fund for teaching.

THE University of Rochester has received more than $300,000 from the late Mary M. Condon to set up a fund known as the John P. Munn Fund in memory of Dr. John P. Munn, former chairman of the board of trustees of the university, whose secretary she had been, for "such university purposes as, in the opinion of the board of trustees, would have been generally favored by Dr. Munn." Miss Condon, who died in 1941, left a gross estate of $134,620 and a net of $129,301, all of which goes to the university. Before her death Miss Condon had turned over more than $190,000 in cash and securities to the university, from the greater part of which the university agreed to pay her the income until her death.

THE recently issued report of the Eastman Dental Dispensary for 1941 states that the Germans have taken over the Brussels and Paris Clinics and are using them to a great extent for services for their troops. The London Clinic, while it has suffered some damage from air raids, is giving about 500 treatments per week to children. In Stockholm, all departments of the clinic are functioning in excellent fashion.

IT is reported in *Nature* that Lord Louis Mountbatten, vice-president of the Institution of Radio Engineers, has given a prize to the institution, to be known as the Mountbatten Medal; it will be "awarded to the candidate who has proved himself the best candidate amongst those of the Royal Navy or Air Force who have presented themselves for the graduateship examinations of the institution held during the year."

DISCUSSION

THE MAGNETIC ION

THE general belief that our universe consists of matter (of the chemical elements) and of electricity is founded on the observations of M. Faraday,[1] who stated that there are material bodies moving in homogeneous electric fields in the direction of the electric lines of force or against them. These bodies, whose direction of motion is reversed with the field, were called "ions" by M. Faraday. Thus an electric ion is a body or particle which carries an excess of positive or negative electric charge.

It is well known that electric ions can be produced by different means such as friction, chemical processes, light and other ionizing agents (for example, radium), etc., and that the charges on these ions can also be changed by the same means.

Magnetism played a secondary role for the last centuries, since during all that time the opinion prevailed that there are no true magnetic charges. No matter how small a body or particle was, it always was supposed to have the same amount of north as of south magnetism. This opinion was based on observations according to which a body directed itself in the direction of the homogeneous magnetic lines of force as a compass needle does in the geomagnetic field, but did not move from its place.[2] Thus a force acting on the north magnetic pole was supposed to be equal to that on the south magnetic one and therefore only such oppositely charged magnetic dipoles were believed to exist. According to J. M. Ampere, each of the dipoles or magnets could be substituted by circular electric currents. Therefore, particles or bodies with an excess of magnetic charge should not exist.

However, more sensitive experiments of F. Ehrenhaft,[3] carried out on very small test bodies with greater mobilities in strong homogeneous magnetic fields, showed that particles of various elements such as Fe, Ni, Sb, etc., move in or against the direction of the lines of force if they were irradiated by light (magneto-photophoresis). From a swarm of such particles, which are suspended in gas, some move towards the north magnetrode some towards the south magnetrode, while others remain at rest. The moving bodies reverse the direction of motion with the field and stop instantly if the magnetic field is shut off. Their velocities increase or decrease if the intensity of the illuminating beam increases or decreases. Furthermore, the test bodies pass very closely to each other in opposite directions.

In the spirit of M. Faraday and J. C. Maxwell one must therefore conclude[4] that there is an excess of magnetic charge on these test bodies which show a distinct motion under the influence of homogeneous magnetic fields. These particles, therefore must be considered as magnetic ions. Furthermore, there are, as F. Ehrenhaft has shown,[5] magnetic currents since the flow of these magnetic ions itself represents a magnetic current.

Just as there are electric ions created by light, light can also produce magnetic ions, *i.e.*, bodies, which move in homogeneous magnetic fields.

In the following recent experiments will be described which demonstrate that the magnetic ions, which are produced by light, are only a special case of a much more general phenomenon. The experiments were executed in an Ehrenhaft condenser[6] whose plates (8 mm in diameter and about 2 mm apart), were the basis of iron cylinders which created a vertical magnetic field whose direction could be reversed at will. A reversible electric field could likewise be applied in the same direction if needed. Both fields were strictly independent from each other. All observations were carried out in the dark field of a microscope (n.a. 0, 36).

If one places a minute amount of very fine powder, such as Fe, Ni, Mn, Cr, Sb, in the exact center of the lower magnetrode, one can see, as soon as the magnetic field is applied, that some of the particles move toward the upper plate, while others remain at rest. It is also possible to place some particles on the upper plate only. Of these some move toward the lower magnetrode as soon as the magnetic field is applied, while the others remain at rest. It is even possible to combine both experiments at the same time. One then observes that some of the particles move toward the north and some toward the south magnetrode, carrying charges opposite to those of the plates, to which they move. The particles arrange themselves on the magnetrodes in the direction of the lines of force and in needle-like masses parallel to each other and perpendicular to the plates. These needles are similar to those which were observed in non-homogeneous fields since De la Hire.[7] Since this

[1] M. Faraday, *Exp. Res. in Electr.*, Vol. I, VIII, 665, 1839.

[2] R. Norman, "A New Attractive," etc., Chapter VI, anno 1576; W. Gilbert, "De Magnete," etc., Book IV, Chapter VI, anno 1628.

[3] F. Ehrenhaft, *C. R.* (*Paris*), 190: 263, 1930; *Phys. Zeitschrift*, 31: 478, 1930; *Phil. Mag.*, XI: 140, 1931.

[4] J. C. Maxwell, "Treat. El. et Magn.," Ed., Oxford, 1873, art. 377–379.

[5] F. Ehrenhaft, *Jour. Franklin Inst.*, 230: 381, 1940; *Nature* (London), 147: 25, 1941; SCIENCE, 94: 232, 1941; *Jour. Franklin Inst.*, 233: 235, 1942.

[6] F. Ehrenhaft, *Sitz. Berichte der Wiener Ak. D. Wiss.*, 119 (IIa), 815, 1910; *Phys. Zeitschr.*, 11: 619, 1910; *Ann. des Physique*, Paris, 13: 151, 1940; *Philosophy of science*, 8: 3, 1941. "The Microcoulomb Experiment" (charges smaller than the electronic charge).

experiment can be performed without light as well, there is evidence of motion of matter under the influence of homogeneous magnetic fields in both directions in darkness too. It is remarkable that one can easily distinguish two kinds of motion if one makes the field slightly non-homogeneous, by putting the plates at a very slight angle. While all ferromagnetic particles move in the direction of the denser lines of force (M. Faraday[8]), thus laterally and non-reversibly with the field, some of them, the charged ones, at the same time also show a superposed motion towards the plates, reversing this motion with the reversal of the field. Instead of placing the particles on the basis of the magnetrodes one can suspend them in gas in the space between the plates and observe in very diffused light a movement towards both plates, which in many cases was reversed with the reversal of the field.

Moreover, even in liquids one can observe such movements, which can only be explained if one assumes the existence of magnetic charges. Colloidal particles, for example, of Ni[9] or powdered particles suspended in various liquids, such as water, castor oil and glycerine, move, when exposed to the influence of homogeneous magnetic fields, toward the gold-plated magnetrodes and are finally deposited on them.

This is evidence that there is a phenomenon analogous to the well-known phenomenon of electrophoresis (cataphoresis)[10] and which should be termed "magneto-phoresis." The micro-photographs show that the deposits are coagulated in similar manner as the deposits of electrophoresis. It is also possible to observe the movement of individual particles under the influence of homogeneous magnetic fields as well as homogeneous electric fields independent of each other. These observations showed that the particles behaved similarly in both fields. However, the difference could be particularly well noticed on Cu particles which moved only in electric fields, but not in magnetic ones and on some iron particles which moved in magnetic fields but not in electric ones.

In order to explain all the phenomena which one can observe on magnetic ions one has to make similar assumptions as in the interpretation of phenomena on electric ions (f.i. change of charge, space charges and double layers). Thus, the changes of direction and of velocity occurring frequently and spontaneously during the observations must be explained as changes of magnetic charge. Up to the present, artificial change of magnetic charge could be achieved by means of irradiation by light and by the application of friction. However, irradiation with radium which changed the electric charge easily did not alter the magnetic charge at all.

The discovery of magnetic ions led to the conclusion that Ampere's[11] hypothesis, stating that every magnet can be substituted in its effects by circular electric currents, can not be considered as valid in general any more, since one can not apply it to bodies, where an excess of magnetic charge has been proved by means of such simple experiments as were described above. It also led to the conclusion of the existence of the magnetic current mentioned before.

The unit of the magnetic current is defined as the flow of the unit of true magnetism through the unit of cross-section during the unit of time. It is understood that the unit of true magnetism is the magnetic charge which exerts a force of one dyne on an equal one placed at the distance of 1 cm in the vacuum.

Other experiments and important conclusions will be reported later.[12]

FELIX EHRENHAFT
LEO BANET

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NEW STEREOISOMERS OF METHYLBIXIN

THE pigment from the seeds of the Annato tree (*Bixa orellana* L.), bixin, $HOOC \cdot C_{22}H_{26} \cdot COOCH_3$, and its methylester, methylbixin, $CH_3OOC \cdot C_{22}H_{26} \cdot COOCH_3$, differ from most natural polyenes in their stereochemical configuration. It was found by earlier investigators[1] that Bixa pigments are labile forms which can be converted into the corresponding stable isomers by iodine, irradiation, etc. Therefore, the natural product and its ester must contain at least one *cis* double bond. Despite the elapse of a decade no further progress has been reported in this field. So far as we know, not even the reversibility of the conversion mentioned has been claimed.

In experiments carried out recently in these laboratories it was shown that numerous stereoisomers of natural[2] and synthetic[3] polyenes can be obtained in a

7 De la Hire, Memoir de l'Acad. Roy. des sciences des Paris, anno 1717.

8 M. Faraday, *Exp. Res. in Electr.*, etc., Vol. III, XXI, 8455, 1855.

9 F. Ehrenhaft, *Akad. Anzeiger d. K. Ak. d. Wiss. Wien*, July 10, 1902, No. XVIII.

10 F. F. Reuss, Mem. Soc. Imp. des Naturalistes de Moscou, 2, 327, 1809.

11 J. M. Ampere, "Exposé de Nouv. dec. sur. l'electr. et le magnet." Paris, 1822.

12 The experiments described above were carried out at Carl Zeiss, Inc., New York, N. Y., where they can be demonstrated by the authors.

1 P. Karrer, A. Helfenstein, R. Widmer and Th. B. van Itallie, *Helv. chim. Acta*, 12: 741, 1929; R. Kuhn and A. Winterstein, *Ber.*, 66: 209, 1933 and 67: 344, 1934; P. Karrer and U. Solmssen, *Helv. chim. Acta*, 20: 1396, 1937.

2 L. Zechmeister, A. L. LeRosen, F. W. Went and L. Pauling, *Proc. Nat. Acad. Sci.*, 27: 468, 1941; A. L. LeRosen and L. Zechmeister, *Jour. Am. Chem. Soc.*, 64: 1075, 1942; L. Zechmeister and W. A. Schroeder, *Jour. Am. Chem. Soc.*, 64: 1173, 1942.

3 L. Zechmeister and A. L. LeRosen, SCIENCE, 95: 587, 1942.

reversible way. The methods used, especially iodine catalysis and melting of crystals, are now being applied to methylbixin. We have found that the *cis-trans* conversion mentioned above is reversible, and furthermore that not a single compound but a complicated equilibrium mixture of stereoisomers is formed. *The latter can be separated on a Tswett column*, using calcium carbonate (Merck's Heavy Powder) and benzene-petroleum ether mixtures.

So far 8 stereoisomeric methylbixins have been observed on the column, above and below the all-*trans* zone; of these several have been crystallized. They differ spectroscopically by 0–16 mμ from the all-*trans* compound which possesses the longest wave-length maxima (490, 457 mμ in petroleum ether). On addition of iodine the spectra of all these stereoisomers shift to about 488.5, 455 mμ.

A new type of rapid isomerization was observed with fresh methylbixin solutions at 20°. No all-*trans* isomer was present in this equilibrium, and it appeared only upon iodine addition.

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SEAWEEDS AT BEAUFORT, NORTH CAROLINA, AS A SOURCE OF AGAR

RECENT articles on methods for reclaiming used agar, on preparation of agar substitutes, and on means of conserving agar give evidence of the increasing concern over future sources of supply, especially for bacteriological requirements.

Agar has been produced commercially on the California coast for a number of years, and this production has been increased considerably during the past few months. However, agar for bacteriological purposes apparently is not being produced along the Atlantic coast. The long-established "Irish moss" industry of Massachusetts seems to be the nearest approach to the production of bacteriological agar in the eastern United States.

On June 1, 1942, an investigation of possibilities of producing agar from seaweeds of the North Carolina coast was begun at the Duke University Marine Laboratory at Beaufort, N. C. Although this work is still in its early stages, it has seemed advisable to announce certain findings because of the pressing need for new sources of agar.

The plans of this work include a systematic test of all the more common, larger species of red algae of the Atlantic coast from Beaufort southward to the Florida Keys but especially in the vicinity of Beaufort.

The most common red alga in certain parts of the Beaufort region during summer is *Gracilaria confervoides* (L.) Greville. Hoyt[1] states that it is present from April to November and that this species has been used "for the making of jellies in a way similar to the use of the 'Irish moss,' *Chondrus crispus*, of our northern coast." Preliminary tests indicate that from 25 to 35 per cent. of the air-dry weight of this alga is agar. Its wet weight is about 17 times that of the dry weight. Agar has been produced from this species at the Duke University Laboratory since about June 15 and has satisfactorily met bacteriological requirements.

The method of preparation used is similar to that given by Field.[2] Freshly collected material is washed with sea water and spread out to dry and bleach. From three days to a week are required for this process. Daily sprinkling with sea water is necessary to make bleaching complete. Whether or not the material is damaged by washing or wetting with fresh water has not yet been determined. When bleached and dry the seaweed is boiled in about 50 times as much fresh water by weight as seaweed. This is kept up to or above 50 per cent. of its original volume by occasionally adding more water during the boiling process. The liquid is then strained through several thicknesses of linen cloth and poured into shallow pans to cool and solidify. From this point on it is treated in a manner similar to that described by Thaller[3] for reclamation of used agar and a reasonably pure product is obtained. A 1.5 per cent. solution forms a sufficiently hard gel in a Petri dish to permit streaking with an inoculating needle.

If a purified agar is not required, 20 grams of dried Gracilaria may be placed in a cloth bag in a flask containing 500 or 600 cc of water (with nutrients if desired). This is autoclaved and the agar solution poured directly into Petri dishes for use.

Gracilaria confervoides is present in certain areas near Beaufort in large quantities and it can be collected with ease. In more favorable localities one person can gather 100 pounds wet weight of this material in an hour. There are many square acres of bottom that produce this alga in such abundance during summer months. Preliminary studies on the possibilities of cultivation of Gracilaria have shown a remarkable growth rate. Small stems about three inches long tied to pieces of tile and placed in a favorable habitat increased about ten-fold in two weeks during July.

Probably the second most common red alga of the Beaufort region during summer is *Hypnea musciformis* (Wulfen) Lamouroux. It is present the year

[1] W. D. Hoyt, *Bull. Bureau Fisheries (U. S.)*, 36: 367–556, 1917.

[2] I. A. Field, Econ. Circ. No. 51, Bureau of Fisheries (U. S.), 1921.

[3] H. I. Thaller, SCIENCE, 96: 23–24, 1942.

around but less abundant during winter. Agar can be made from this species also; that produced so far has been of inferior but usable quality. Difficulty has been encountered in bleaching Hypnea, although perfectly bleached pieces are sometimes found along the beach.

Tests on species of algae that are not sufficiently abundant at any time of year to afford a significant supply of agar are being carried out in the hope that, should some exceptionally favorable species be found, methods for cultivation can be worked out. *Lomentaria uncinata* Meneghini, for example, yields a very high percentage of agar, but because it is such a small plant and not very abundant, it is commercially out of the question. Many species at Beaufort are restricted in abundance only because of the limited extent of suitable surfaces to which they can attach.

Early in June determinations were made on the alginic acid content of two species of pelagic Sargassum, *S. natans* (L.) Meyen and *S. fluitans* Børgesen. Apparently the alginic acid content of these is very small. Similar determinations are planned for all the more common, large species of brown algae.

HAROLD J. HUMM

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THE CAUSE OF DOMESTICATION

THE suggestion that the dog may have been domesticated in part for its value as a scavenger[1] may have some pertinence, but we should not forget that primitive people do not object to smells as much as we do, and that they seem to care very little about sanitation. Moreover, most of them lived so they could move easily and probably they did move rather frequently, thus wittingly or unwittingly solving the refuse problem.

While utility has been a great factor in all domesticating, it is not all-powerful, for, if it were, the list of domesticated organisms would be much larger than it is. In other words, we could profitably use the qualifications of many that have not been reduced to domestication.

It is nearly, if not entirely, true that prehistoric man did all the domesticating. Hence, if we are not prepared to admit that he had faculties along this line superior to those of historic man, we must conclude that the organisms domesticated, themselves contributed to the result. As the admission can scarcely be made, the conclusion is unavoidable. The dog is a clear example; it prefers to associate with man. Tamability exists in gradations; some creatures readily tame, others are refractory. The domesticated forms derive from the more susceptible kinds and, considering primitive man's success in contrast to advanced man's failure in domestications, it seems certain that the organisms involved must have had favorable tendencies to that state and must have helped to domesticate themselves.

W. L. MCATEE

U. S. FISH AND WILDLIFE SERVICE,
WASHINGTON, D. C.

[1] SCIENCE, 96: 111–112, July 31, 1942.

OFFPRINTS FOR THE SCIENTIFIC MEN OF SOVIET RUSSIA

I HAVE recently received a letter, dated May 25, 1942, from Professor Alexander R. Luria, the prominent Russian psychologist. Professor Luria, whose book in English, "The Nature of Human Conflict," is well known to American readers and who was scheduled to visit this country to deliver the Salmon Memorial Lectures at the New York Academy of Medicine, is now in the Province of Cheliabinsk in the Ural Mountains. He is directing a clinic for the rehabilitation of the brain-injured in the war. He writes that he and his colleagues are very much in need of offprints from recent original American publications in the field of brain pathology and abnormal psychology, particularly those dealing with re-education and neurosurgery. He would like to receive such material as immediately as possible.

The American-Russian Committee for Medical Aid to the USSR, of which Prince Vladimir V. Koudasheff is the chairman and Dr. Michael Michailovsky is the treasurer, has kindly offered to transmit to Professor Luria literature sent to them and designated for him. Their address is 55 West 42d Street, New York, N. Y. It is also possible to mail directly to Professor A. R. Luria, Neurosurgical Rehabilitative Clinic of VIEM, Kisegatch Sanatorium, Cheliabinsk Oblast, USSR.

It is hoped that American scientists who have pertinent material will heed this call. It may furthermore be presumed that the needs of Professor Luria and his clinic are typical, and that in general American scientists who have formerly corresponded with Russian colleagues should continue sending important offprints that in some way bear upon war needs. Indeed, only three months ago the writer received a request from the Tbilisi Institute of Physiology for an offprint that is neither very important nor remotely related to war research. However, the situation has doubtlessly changed since, and correspondents may do well to discriminate for the time being in what they send.

The U. S. Post Office accepts first-class matter and printed material not exceeding four pounds and six ounces for mailing to the USSR, and wherever locations of institutes and universities have been changed, as many have, the Soviet authorities no doubt have the information for proper forwarding.

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QUOTATIONS

THEY ALSO SUFFER

WHILE war ravages humanity, lower forms of life get scant consideration. Even in times of peace it is difficult to protect the flowers, forests, birds and beasts, and when war comes the bars are wholly down. In the jungles of Malaysia and Papuasia, the wealth of life is so overpowering it is doubtful if thousands of "infiltrating" soldiers can do much permanent harm, but even there some animal and plant life is jeopardized. This is especially true on small islands which often form the exclusive habitat of peculiar animals. A soldier off duty is seldom averse to shooting anything subhuman and he is especially willing when it may provide a variation for the daily mess. He can not be fighting all the time, and his opportunities for wantonness must be frequent. As Kipling pointed out, we can not expect even our own men to be "plaster saints," and when it comes to our enemies, especially the Japanese, there is little hope.

The war has spread to so many out-of-the-way places that natural conditions are bound to be greatly disturbed, and it is not unlikely that exterminations or near exterminations will be among the many deplorable by-products. On the treeless Aleutian Islands of Attu and Kiska, recently occupied by the Japanese, are distinct species of ptarmigan, handsome grouse-like birds, nominally protected by our laws, but doubtless due to go into the soldier's pot by hundreds. In this region also is the sea otter, one of the most interesting of living mammals and one of great potential economic value. From the verge of extinction it has just been restored to numbers thought to guarantee its continuation, but under war conditions its fate may again become uncertain. Another important animal of this region is the fur seal which passes regularly through the Aleutians on its migrations. It is interesting to note that our long-standing treaty with Japan, by which she agreed not to kill seals on the high seas, was abrogated before war began. This treaty was profitable to Japan, and her refusal to continue it seems explainable only on the assumption that she expected to occupy our territory.

Examples of threats in other regions could be multiplied. North Africa, especially, might furnish a number, but there are some much nearer home. The danger to our western forests from fires set by incendiary bombs is a very real one which was quickly recognized, and protective measures are doubtless being taken, but the task is well-nigh insuperable. We can only hope for success.

As so often said, our first business is to win the war, but the naturalists and conservationists can scarcely be blamed if their thoughts and sympathies turn occasionally to the killings that are not mentioned in the official communiqués.

Field Museum News

SCIENTIFIC BOOKS

ASTRONOMY

Essentials of Astronomy. By JOHN CHARLES DUNCAN. Illustrated. 181 pp., 14 appendices, star maps. New York: *Harper and Bros.* $1.85.

CELESTIAL coordinates, spectrum analysis, proper motion—these are the straws which often strain teacher and student alike in the usual college first-year course in astronomy. Also, to greater degree, they and other concepts overthrow good intentions of would-be amateur astronomers and intelligent laymen taking extension and adult education courses.

A formidable text does not help particularly when 90 per cent. of such students are probably making their first and last serious contact with astronomy.

Write a volume in simple, fluid terms (such as should be expected from one of America's best-known teachers of astronomy). Do not, however, be condescending—retain the language of the subject, and include briefly its latest advances. Give them a common-sense introduction to the sky as they see it: "The Appearance of the Sky." Follow later with compact fundamentals:

"The kinship of all the stars, including the sun, is revealed by their spectra which, being of dark lines on a continuous background, show that each star has an intensely hot interior which shines through an enveloping atmosphere of less highly heated gas."

Give them a comparatively thin volume, well illustrated and diagrammed. Give them a Kodachrome (four-color) frontispiece of well-known Orion—the pioneering achievement of "Essentials of Astronomy." Give them attractive star maps. Price the book reasonably.

Wellesley's professor of astronomy has done just these things, and as a result, astronomy classes which follow his lead should have many more "satisfied survivors" than before.

CHARLES A. FEDERER, JR.

HARVARD COLLEGE OBSERVATORY

THE FLORA OF FUKIEN PROVINCE, CHINA

Flora of Fukien and Floristic Notes on Southeastern China. 1 (1). By F. P. METCALF. xviii + 82 pp. 2 maps. 1942.

THIS first part of a projected flora of Fukien

Province, China, is much more than a flora of that particular province. While the Fukien species of the families treated are considered in detail, with keys to genera and species, descriptions, synonymy and citation of specimens, a great many species from neighboring provinces are included, particularly those of Chekiang, Kiangsi, Kwangtung, Hunan and Kwangsi. In addition to the introductory and historical matter appertaining to the Province of Fukien, many species occurring in neighboring provinces are described. The first part, now available, considers the families and genera of the Gymnospermae and the dicotyledonous families from the Casuarinaceae to the Fagaceae, inclusive. The work is published by Lingnan University, 150 Fifth Avenue, New York.

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REPORTS

THE NATIONAL HEALTH IN GREAT BRITAIN AFTER NEARLY THREE YEARS OF WAR[1]

GOOD reports on the national health during the war have previously been given. The survey can now be extended to the third winter of the war and most of the third year, with similar results. In the House of Commons the minister of health, Mr. Ernest Brown, stated that after one thousand days of war the health of the nation was in many respects better than in days of peace. The birth rate of 1941 was 14.2 per thousand as compared with 15.1 in 1938 and 20.9 in 1916. (This only exemplifies the falling birth rate, which was causing concern before the war). But for the first quarter of 1942 the rate was 15.5, the highest in any March quarter since 1931. The rise can be accounted for by the increase of marriages promoted by the allowances paid for wives and children of the young men joining the fighting services. The infant mortality rate for 1941 was 59, as compared with 53 in 1938 and 91 in 1916. The rate for the first quarter of 1942 was 61, the lowest rate for any first quarter on record. The maternal mortality rate in 1941 was 2.77 per thousand births as compared with 2.97 in 1936 and 4.12 in 1916. Thus while over a long period the birth rate had been falling, over the same period the survival rate had increased. The "crude general death rate" was 12.9 in 1941 as compared with 11.6 (the lowest on record) in 1938 and 14.4 in 1936. The risk of epidemic disease calls for special care in wartime, but during the past two and one half years of war the infectious disease rate has been normal and, on the whole, below the average.

Apart from tuberculosis, the only infectious disease which has shown a rise during the war is cerebrospinal fever. This was expected, since cerebrospinal fever has always been a wartime disease. In 1916 there were about 2,000 cases and in 1938 and 1939, 1,500 and 1,300, respectively. But in 1940 there were nearly 13,000 and in 1941 over 11,000 and, for the first half of 1942, 4,000. The fatality of the disease has been reduced from a percentage of 69 in 1935 to 34 and more recently to 20.

[1] London correspondent of the *Journal* of the American Medical Association.

The problem of tuberculosis is causing some concern. There were 28,669 deaths due to it in 1941, compared with 28,144 in 1940, 26,176 in 1938 and 53,858 in 1916. The steady fall in tuberculosis which has been a feature of the twenty-five years of peace has been interrupted in the last two years. Wartime conditions, such as the blackout, overcrowding and the cessation of house building, predispose to tuberculosis. In the past we tended to concentrate on treatment rather than on early diagnosis. The recent developments in miniature radiography are providing a new weapon to detect cases for more detailed examination. From earlier diagnosis better results in treatment are expected. Also rehabilitation and securing gradual return to suitable employment is to be tackled on more comprehensive lines.

The incidence of diphtheria, the chief killing disease of children between 4 and 10, has not fluctuated very widely in the last twenty-five years, but the number of deaths has fallen from 5,300 in 1916 to 2,600 in 1941. During the past year the Ministry of Health has been engaged in a campaign for immunization of children against diphtheria, and this has given striking results in reducing both incidence and fatality of the disease. Scarlet fever has become a scourge of the past, and there were only 133 deaths from it in 1941. In that year there were only 148 deaths from typhoid and fewer than 5,000 as compared with 6,000 cases and 1,100 deaths in 1916. During the heavy bombing of our cities not a single death from typhoid was due to pollution by water-borne infection, in spite of the continuous bombing of our crowded areas. American visitors marveled at this. The number of deaths from pneumonia was much greater in 1941 than from all the other infectious diseases combined other than tuberculosis. There were 50,000 cases and 26,000 deaths, compared with 29,000 deaths in 1940 and 23,000 in 1939.

An increase in venereal diseases was not unexpected in view of war conditions but was not so great as in the last war. At the outset steps were taken to expand the existing services. We have always relied on propaganda and education for controlling these diseases. But the work of limiting the spread of infec-

tion was hampered by lack of powers to deal with persons unwilling to submit to treatment and known to infect others. This difficult problem is engaging attention.

At the end of April, 1939, the number of state-registered nurses was 94,200. In April, 1942, the number had risen to 103,700. But there is still a shortage, and 12,000 more are required. The tuberculosis service in particular has exceptional difficulties in securing adequate numbers. Fear of contracting the disease in sanatoriums appears to be a factor, though the authorities hold that there is no greater risk than in other hospitals.

The demand for doctors in the fighting forces has entailed a shortage for civilian purposes. The government has asked the public to recognize the difficulty and do what it can to limit calls to what is essential.

SPECIAL ARTICLES

ABSORPTION OF SELENIUM BY CORN FROM ASTRAGALUS EXTRACTS AND SOLUTIONS CONTAINING PROTEINS

BESIDES being highly toxic to livestock, selenium indicator plants serve as converters of selenium. They absorb selenium from the soil, change it into water-soluble compounds, and through decay return it to the soil in forms readily available for absorption by all types of plants, including farm crops. Soil-plot experiments by Beath and his associates[1] have shown that selenium derived from a water extract of an indicator plant is much more readily accumulated than selenium from an inorganic compound such as sodium selenite.

We have recently made a quantitative comparison of a water extract of *Astragalus bisulcatus* and sodium selenite (Na_2SeO_3) as sources of selenium for absorption and accumulation by young corn plants growing in solution cultures. Another phase of our study dealt with the possible influence of proteins and their derivatives on the absorption of inorganic sodium selenite.

Pioneer hybrid corn no. 307 was germinated in quartz sand. When the seedlings were about 8 cm high they were transferred to a mineral culture solution of the usual composition[2] to which either *Astragalus* extract or sodium selenite had been added. The culture solutions were renewed twice a week, and after the plants had grown for three weeks they were dried, weighed and analyzed for selenium. The extract was prepared by soaking finely ground seleniferous *Astragalus bisulcatus* in culture solution for 16 hours at room temperature and then filtering with suction; about 75 per cent. of the selenium in the *Astragalus* powder was removed, and the extract contained approximately 40 ppm of selenium.

The curves in Fig. 1 show far greater absorption and accumulation of selenium from a water extract of *Astragalus* than from sodium selenite. The selenium content of the corn seedlings receiving the *Astragalus* extract was from 12 to 20 times as high as that of the seedlings receiving sodium selenite. Maximum accumulation was 3,150 ppm[3] in the *Astragalus* extract series as compared with only 235 ppm in the sodium selenite series. Although reduction in growth was

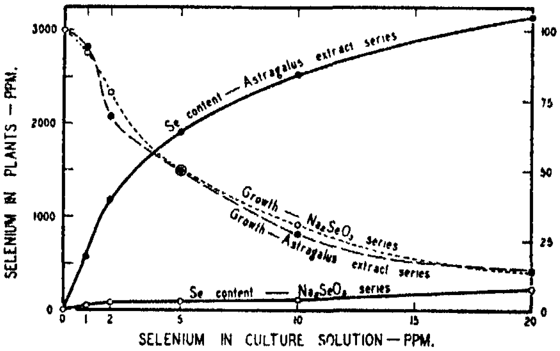

FIG. 1

about the same in both series for equivalent concentrations of selenium in the culture solution, it is evident that, per unit of selenium accumulated, the selenium in the *Astragalus* extract was much less toxic than the inorganic sodium selenite.

The selenium occurs in the extract as part of an organic compound—not as the selenite or selenate ion. Dialysis has shown that the selenium is present in molecules sufficiently small to diffuse readily through a Cellophane membrane (Du Pont or Visking), since it became equally distributed on both sides of the membrane within 48 hours at 5° C. The dialyzed selenium and the selenium in the original extract exhibited the same toxicity, and they were accumulated to the same degree by young corn plants.

In view of the much greater accumulation of selenium from an *Astragalus* extract than from sodium selenite, it seemed of interest to determine whether the addition of an organic substance to the culture solution would increase the absorption of inorganic sodium selenite. Various proteins, protein derivatives and

[1] O. A. Beath, H. F. Eppson and C. S. Gilbert, *Wyo. Agr. Exp. Sta. Bull.*, 206, 1935.

[2] S. F. Trelease and H. M. Trelease, *Am. Jour. Bot.*, 26: 530–535, 1939.

[3] This is one hundred times the maximum reported for lethal corn from naturally seleniferous soils. See: S. F. Trelease, *Scientific Monthly*, 54: 12–28, January, 1942.

amino acids (Difco) were added, each in a concentration of 50 ppm, to a culture solution containing 5 ppm of selenium as sodium selenite. Table I shows that at

TABLE I

INFLUENCE OF VARIOUS PROTEINS AND AMINO ACIDS IN THE CULTURE SOLUTION ON THE ACCUMULATION BY CORN SEEDLINGS OF SELENIUM SUPPLIED AS SODIUM SELENITE

Protein or amino acid in culture solution, 50 ppm.	Selenium series (5 ppm. Se as Na_2SeO_3)		Control series* (No selenium)
	Se content of plants, ppm.	Ave. dry wt. of tops, g.	Ave. dry wt. of tops, g.
Bactotryptone	471	0.90	2.23
Neopeptone	420	0.87	2.10
Sodium caseinate	413	0.92	2.26
Proteose peptone	396	0.95	3.37
Alanine	324	0.78	2.27
Tyrosine	264	1.02	2.63
Cystine	253	1.00	2.87
Tryptophane	205	1.12	2.20
Control	192	1.14	2.47
Alfalfa hay extract	319	0.80	1.17
Control	143	1.27	2.20
String-bean extract	285	0.84	0.83
Control	132	0.66	1.04

* Analysis showed that these plants contained no selenium.

least four of these substances—bactotryptone, neopeptone, sodium caseinate and proteose peptone—approximately doubled the accumulation of selenium, and smaller increases were obtained with the other substances tested. It may be noted also that water extracts of alfalfa hay and of string beans had a marked effect in increasing selenium absorption.

Fig. 2 shows that increasing the concentration of

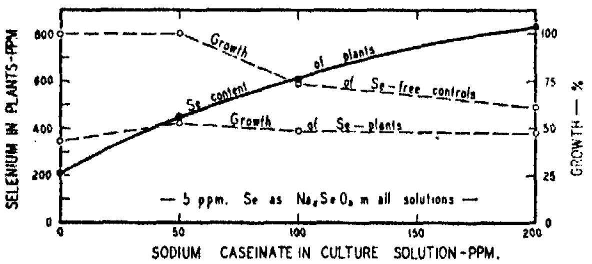

FIG. 2

sodium caseinate in a solution containing 5 ppm of selenium as sodium selenite brought about a progressive increase in the accumulation of selenium by the corn plants. With 200 ppm of sodium caseinate, the corn plants stored 830 ppm of selenium, or four times the concentration accumulated in the absence of the protein. It is of interest in this connection to note that the toxicity of selenium to rats has been found to be markedly reduced by a high proportion of protein, particularly casein, in the diet.[4]

In conclusion, it may be suggested that soils naturally high in nitrogenous organic substances may allow greater selenium accumulation by crop plants and native grasses than soils low in such substances. It would be expected that preparation of a grain field in a seleniferous area by plowing under a leguminous crop might markedly increase the absorption of selenium by the grain. Corn, other cultivated grains and native grasses, though unable to rival the true indicator plants, might nevertheless be capable of significant activity as selenium accumulators and converters in a soil rich in organic material.

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[4] R. A. Gortner, Jr., *Jour. Nutrit.*, 19: 105–112, 1940.

FACTORS INFLUENCING CAPILLARY PERMEABILITY IN THE VITAMIN E DEFICIENT CHICK[1]

INCREASED permeability of capillaries resulting in diffuse hemorrhage and exudation of plasma, as well as in increased migration of intravenously injected colloidal dyes into the tissues, was found by us to be an outstanding feature of vitamin E deficiency in chicks.[2, 3, 4, 5]

A further study of this condition has shown that it is possible to influence the intensity of this symptom very much by certain modifications of the diet which do not affect the vitamin E content.

Thus the appearance of exudates can be delayed and the incidence and severity of the symptom reduced by lowering of the concentration of soluble salts in the diet, whereas a high concentration of such salts—phosphates or sodium chloride—has the opposite effect. By suddenly raising the content of soluble salts considerably, exudates in the pericardium and the peritoneum and edema of muscle tissue can be produced as a regular symptom, whereas such exudates are rare on the same diet with low salt content. This observation affords some explanation as to why Bird and Culton[6] found the symptoms to be more severe on their diet (which contained 54 per cent. of dried skim milk and 1 per cent. of sodium chloride) than on our previously used diet, which has a lower salt content.

Acceleration of the onset of exudates can also be obtained by incorporating a trace of histamine in the

[1] Acknowledgement is made to the Josiah Macy Jr. Foundation for aid in conducting this work. Thanks are due to Hoffman LaRoche, Nutley, N. J., for furnishing synthetic alpha-tocopherol acetate (Ephynal acetate) and to Dr. L. R. Dragstedt, of the University of Chicago, and The Lilly Research Laboratories, Indianapolis, Ind., for lipocaic.

[2] H. Dam and J. Glavind, *Nature*, 142: 1077, 1938.

[3] *Idem, Nature*, 143: 810, 1939.

[4] *Idem, Skandinavisches Archiv f. Physiologie*, 82: 299, 1939.

[5] *Idem, Die Naturwissenschaften*, 28: 207, 1940.

[6] H. R. Bird and Th. G. Culton, *Proc. Soc. Exp. Biol. and Med.*, 44: 543, 1940.

diet or by raising the cholesterol content to about 1 per cent. That a high fat content in the diet favors the symptoms has previously been reported.[7]

These observations are interpreted by the assumption that certain regions of the capillary systems of the E-deficient chick are unable to withstand even the normal osmotic pressure of the blood and that the capillaries are easily damaged by histamine or an abnormally high supply of cholesterol as well as by other possible changes in the milieu with which the capillary wall is in contact.

The fact that fat and cholesterol favor the symptom suggested to us that it might be desirable to test the effect of some lipotropic substances.

Incorporation in the vitamin E deficient diet of 2 per cent. Lipocaic, a water-soluble preparation from pancreas (L. R. Dragstedt, *et al.*)[8] gave a high degree of protection against exudates even if the diet contained a relatively high amount of salts such as 7.2 per cent. of McCollum's salt mixture number 185. A chemical test showed that the effect of the lipocaic preparation could not be due to contamination with vitamin E. Inositol was then tested because Gavin and McHenry[9] have reported that this substance has a similar lipotropic effect as lipocaic. 1.5 per cent. of inositol in the diet was found to give a high degree of protection, whereas 1.1 per cent. of choline chloride was without any effect. Ineffective also was 5 per cent. gum arabic and 2 per cent. of acetone treated soy bean phosphatide was nearly ineffective.

This is believed to be the first instance where nonlipoid substances of animal origin have been found to counteract a symptom of vitamin E deficiency. An investigation as to whether these substances will also counteract other symptoms of lack of vitamin E, as well as a study of the protective factor in the lipocaic preparation and the way in which it acts, should be of importance in the elucidation of the mode of action of vitamin E.

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[7] H. Dam, J. Glavind, I. Prange and J. Ottesen, Royal Danish Academy of Science, *Biological Communications*, 16: 7, 1941.

[8] L. R. Dragstedt, C. Vermeulen, W. C. Goodpasture, P. B. Donovan and W. A. Geer, *Archives of Internal Medicine*, 64: 1017, 1939.

[9] G. Gavin and E. W. McHenry, *Jour. Biol. Chem.*, 139: 485, 1941.

MECHANISM OF SULFONAMIDE ACTION. II. INHIBITION OF BACTERIAL RESPIRATION BY SULFANILAMIDE AND BY ITS INACTIVE ISOMERS

UNTIL very recently the only valid method for the study of sulfonamide action was based upon chemotherapeutic experiments, using animals infected with pathogenic bacteria. Recent investigations of the competitive inhibition of sulfonamides by *p*-aminobenzoic acid have shown that this antagonism can be made the basis of a suitable *in vitro* method.[1] The mechanism of the sulfonamide action is not clearly revealed by the *in vivo* experiments, and even the *in vitro* experiments based upon *p*-aminobenzoic acid antagonism involve the over-all process of bacterial growth in measuring sulfonamide activity. A recent report by Sevag *et al.*[2] attracted our attention because it was an attempt to study chemotherapeutic action of sulfonamides on a less intricate system. Our experiments using this method have convinced us that the inhibition of bacterial respiration by high concentrations of sulfonamides should not be regarded as typical sulfonamide action. We have found, for example, that the respiration of resting cells of *Escherichia coli*, *Staphylococcus aureus* or of *Streptococcus pyogenes* prepared after the manner of Sevag, is inhibited by the meta and ortho derivatives of amino benzenesulfonamide just as by sulfanilamide itself. The data in Table I show that of the two chemotherapeutically inactive isomers, the meta form behaves exactly as sulfanilamide, while the ortho form gives considerably more inhibition.

TABLE I

EFFECT OF .04 M SULFANILAMIDE AND ITS ISOMERS ON BACTERIAL RESPIRATION ON GLUCOSE IN M/60 PHOSPHATE BUFFER IN AIR

	Control		Sulfanilamide		Metanilamide		Orthanilamide	
pH	6.2	7.2	6.2	7.2	6.2	7.2	6.2	7.2
E. coli Q_{O_2}	37	38	25	24	26	25	12	11
Inhibition			32 per cent.	37 per cent.	30 per cent.	34 per cent.	67 per cent.	71 per cent.
Staph. aureus Q_{O_2}	63	51	41	38	39	35	23	30
Inhibition			35 per cent.	25 per cent.	38 per cent.	31 per cent.	63 per cent.	41 per cent.
Strep. pyogenes Q_{O_2}	55	50	44	36	44	36	35	29
Inhibition			20 per cent.	28 per cent.	20 per cent.	28 per cent.	36 per cent.	42 per cent.

E. coli is a typical fecal strain.
Staph. aureus is F.D.A. strain.
Strep. pyogenes is strain 1896 M obtained from Dr. J. S. Lockwood, University of Pennsylvania.

[1] Orville Wyss, K. K. Grubaugh and F. C. Schmelkes, *Proc. Soc. Exp. Biol. and Med.*, 49: 618–622, 1942; H. M. Rose and C. L. Fox, SCIENCE, 95: 412–413, 1942; W. B. Wood, *Jour. Exp. Med.*, 75: 369–381, 1942.

[2] M. G. Sevag and M. Shelburne, *Jour. Bact.*, 43: 411–462, 1942.

In addition to showing that compounds totally devoid of chemotherapeutic activity (*i.e.*, true sulfonamide action) give inhibition equal to or exceeding that given by sulfanilamide, these data also show that the inhibition of the hemolytic streptococcus is not greater than that of the staphylococcus which generally is more resistant to sulfonamides.

Further, the effect upon respiration of a more active sulfonamide, sulfacetimide, was compared with that of sulfanilamide. This compound was selected because it would dissolve in .04 M concentrations. Preliminary experiments with sulfathiazole indicated that significant reductions of the rate of respiration could not be obtained with concentrations up to 100 mg per cent., the upper limit of solubility.

TABLE II

EFFECT OF .04 M SULFANILAMIDE AND SULFACETIMIDE ON RESPIRATION OF *E. coli* ON GLUCOSE IN M/60 PHOSPHATE BUFFER IN AIR

	Q_{O_2}		
	Control	.04 M Sulfanilamide	.04 M Sulfacetimide
pH 6.2	155	126	125
Inhibition ..		19 per cent.	19 per cent.
pH 7.2	143	126	121
Inhibition ..		12 per cent.	15 per cent.

Sulfacetimide shows no greater activity in this experiment than sulfanilamide. When 10 mg per cent. *p*-aminobenzoic acid was added to some of the flasks containing .04 M sulfonamide it did not reverse the inhibition of respiration by either sulfanilamide or sulfacetimide.

Finally an attempt was made to compare inhibition of respiration and of growth, using resistant organisms. The relative sulfonamide resistance of a parent strain of *E. coli* and a resistant strain developed from it is given in Table III.

TABLE III

CONCENTRATIONS OF SULFONAMIDES PERMITTING ONE-HALF MAXIMUM GROWTH RATE OF *E. coli* IN SYNTHETIC MEDIUM AT pH 7.0

	Parent Strain	Resistant Strain
Sulfanilamide ...	3.4 mg per cent.	62 mg per cent.
Sulfaguanidine ..	3.4	63
Sulfapyridine ...	.17	1.6
Sulfadiazine	.077	.34
Sulfathiazole	.073	.35

Inoculum = 100,000 cells per ml.

However, when the effect of .04 M sulfanilamide on the respiration of resting cells of these organisms was compared, equal inhibition was obtained with both strains.

TABLE IV

EFFECT OF .04 M SULFANILAMIDE ON GLUCOSE RESPIRATION OF RESISTANT AND NON-RESISTANT *E. coli* IN M/60 PHOSPHATE BUFFER, pH 7.2 IN AIR

	Control Q_{O_2}	.04 M Sulfanilamide Q_{O_2}
Parent strain	61	52
Inhibition		15 per cent.
Resistant strain ..	69	58
Inhibition		16 per cent.

SUMMARY

These data indicate that the inhibition of bacterial respiration is not a suitable criterion for the presence or absence of true sulfonamide activity.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

MICROMETER BURETTE

THE microburette recently described by Scholander[1] in common with all other modifications of a Rehberg burette[2] can only be used with solutions that do not attack mercury. Burettes of this type get dirty quickly, probably because grease creeps along the mercury. They are also hard to clean. To avoid these difficulties, we have constructed and used a burette combining a micrometer with a syringe, as has been done in one imported microburette. The anvil of a micrometer is cut off and a glass syringe mounted on a simple clamp in line with the spindle. Rubber bands attached to two hooks near the knurled head of the micrometer and to the plunger hold the latter tight against the spindle. A delivery tube can be attached to the syringe with a No. 0 one-hole rubber stopper; or if necessary a broken syringe of the same glass can be drawn out and fused on to the orifice of the syringe. A brass washer should be cemented to the outer end of the plunger and accurately perpendicular to its axis to act as a thrust bearing against the spindle. This bearing should be oiled occasionally. A convenient support can be made by screwing the yoke of the micrometer to the boss of a universal burette clamp, which can then be attached to a ring stand. The clamps on the syringe should be lined with friction tape to protect the glass and prevent slippage. Extra clamps permit the use of syringes of different sizes. We have used a 1-inch micrometer which delivers about 0.4 cc from a 1 cc tuberculin syringe or 1.5 cc from a standard 2 cc syringe. The syringes can

[1] P. F. Scholander, SCIENCE, 95: 177, 1942.
[2] P. B. Rehberg, *Biochem. Jour.*, 19: 270, 1925.

SCIENCE NEWS

Science Service, Washington, D. C.

SPECTRAL LINES

A SUBSTANCE impossible on this earth, but lying in the vast stretches of so-called "empty" space between the stars, partly clears up an astronomical mystery of long standing. It accounts for three of four spectral lines that have puzzled astronomers. The fourth is still unexplained.

The substance is hydrogen carbide or carbon hydride, whichever you prefer to call it. But astronomers simply call it CH, for the molecule is composed of one atom of carbon and one of hydrogen. The final step in the proof was accomplished by two Canadian physicists who looked not at the sky but through the eyepiece of a spectrometer in the laboratory. The physicists are Dr. A. E. Douglas, of the National Research Laboratories in Ottawa, and Professor G. Herzberg, physicist at the University of Saskatchewan.

The spectrometer is the instrument that spreads light out in a rainbow and tells what things are made of here and in the skies, provided the spectrum "lines" are identified with similar lines given by a known substance. Each line corresponds to a particular wavelength of light. A good instrument will measure this to a 25-billionth of an inch. Astronomers examining the stars with this instrument have noted four sharp lines which did not correspond to those of any known substance. On theoretical grounds and as a result of mathematical calculations they attributed them to CH, existing in the space between the stars. Much of this work was done by Dr. Theodore Dunham, Jr., and Dr. Walter S. Adams, of the Mount Wilson Observatory in California, and Dr. Andrew McKellar, of the Dominion Astrophysical Observatory, B. C.

But the astronomers could not be sure of their conclusion, because since CH does not exist on the earth, its "lines" had never been seen. All this has now been remedied, for Dr. Douglas and Dr. Herzberg have produced three of the lines in the laboratory and positively identified them as belonging to CH. The fourth line which did not appear, they gave good reasons for believing does not belong to CH. Hence the fourth line still remains a mystery.

The reason why CH, and we may add CH_2 and CH_3, are "impossible" compounds on this earth is that the normal quota of the carbon atom is four atoms of hydrogen. If it has a less number, it is unsatisfied or "unsaturated," and immediately sets out to fill its quota. It may accept other atoms than hydrogen or it may join with other unsaturated hydrocarbons to form the large groups or the long chains that compose the molecules of petroleum, rubber and other organic compounds.

The carbon atom has no difficulty here in filling its quota, with plenty of materials close at hand, 500 billion billion molecules to a cubic inch of air. But out there in "empty space" it is believed that there is about one atom or molecule to a cubic yard. If the carbon atom were magnified to the size of a pea, and the cubic yard were similarly magnified, there would not be another atom of any sort within a million miles. The carbon atom would be lucky to get even one hydrogen atom to share its loneliness, and however much it might yearn for more, it would be a long time before it got any. CH can therefore very well exist for prolonged periods in "empty" space.

The manner in which the CH lines were produced in the laboratory was by admitting a small amount of benzene to an atmosphere of inert helium gas and passing an electric discharge. Apparently the discharge broke up the hydrocarbon molecules of the benzene and CH existed momentarily while the carbon atoms were filling their quotas. How short this time is may be gathered from the fact that CH_3, which would be the most stable of the three compounds, had previously been produced in the laboratory, but half of it disappears in 1/1,000 to 1/10,000 second. The lines obtained were very faint. Exposures of one to ten hours were required to photograph them.

Twice before have mysterious spectral lines puzzled astronomers. They were then attributed to new elements not yet discovered on the earth, but in both cases they turned out to be very common earthly substances, but in a peculiar state. They were the mysterious green lines seen in the spectra of nebulae, which were attributed to an unknown element, which was called "nebulium." But in 1927, Dr. I. S. Bowen, of the California Institute of Technology, showed that it was simply oxygen and nitrogen emitting "forbidden" lines, possible only when the gases are extremely attenuated. Again, a conspicuous green line and others in the spectrum of the sun's corona were attributed to an unearthly element and named "coronium." But in 1941, the Swedish astronomer, Dr. Bengt Edlen, showed that these lines were probably due to atoms of iron and calcium stripped of most of their electrons by some powerful agency that had not been duplicated on the earth. Finally, 1942, the Indian scientist, M. N. Saha, proposed that the highly damaged atoms were produced by "fission," the famous process by which physicists are seeking atomic power.

In any case it is believed that all possible elements have now been discovered. No new ones will be found in the sky.—MORTON MOTT-SMITH.

THE GROWTH OF PLANTS

WHAT plants want for growth, reduced to simplest possible terms by experimenting with separated bits of plant tissue, was described at North Truro, Mass., at the annual symposium of the Society for the Study of Growth, by Dr. Philip R. White, of the Rockefeller Institute for Medical Research at Princeton, N. J.

Dr. White used three kinds of plant tissue cultures, similar to the chick heart and other animal tissue cultures made famous by the classic studies of Dr. Alexis Carrel. They were detached root-pieces of tomato and other plants, fragments of abnormal tumor-like growths

produced by a hybrid tobacco whose parent strains "disagreed with each other" and pieces of crown-gall growth provoked on sunflower stems by bacterial attack.

Plant tissues, it was found, need eleven mineral salts (containing sixteen elements), a supply of carbohydrate, three vitamins and one amino acid. Omission of some, like magnesium, calcium or sugar, causes immediate stopping of growth. Lack of others results in slowed-down or abnormal growth.

In the case of the masses of tissue from the tumor-like formations Dr. White found that the oxygen supply had a great deal to do with the kind of growth that would occur. As long as there was plenty of oxygen, they kept on producing cells that were practically all alike growing in no particular direction. But when any of these irregular lumps happened to sink beneath the surface of the nutrient fluid, thus reducing the oxygen supply, it would begin to develop stems and leaves. Brought up to the air again, it would revert to its original formless condition.

Dr. White expressed the belief that there must be other kinds of plant material that would lend themselves equally well to experiments on growth control, leading eventually to information of value in such widely separated fields of research as the growth of diseased tissue and the growth of crops.—FRANK THONE.

COLCHICINE

COLCHICINE, known nowadays primarily for its use in originating new plant varieties, is used by Professor Edgar Allen and his co-workers at the Yale Medical School as a key to new knowledge on animal reproduction, and, incidentally, on the ever-present problem of cancer. He told of some of his researches at the North Truro meeting of the Society for the Study of Growth.

Colchicine is of value in this work, Professor Allen explained, because it "freezes" dividing cells in exactly the condition in which it finds them. Thus he is able to give supplemental doses of sex hormones to female rats and other small laboratory animals, follow that with injections of colchicine, and then kill and dissect his specimens at various time intervals, getting a series of clear pictures of just what has been going on.

One of the things he has found out is that the female sex gland at each reproductive cycle starts to develop several times as many eggs as it finally discharges. As many as four fifths of those that start never finish. The colchicine technique shows up the unsuccessful ones, some growing abnormally inside, others developing abnormally outside; the few that are "chosen" maintaining an even developmental balance throughout. Nobody knows as yet why this happens. If the secret is eventually discovered it will obviously help in giving an understanding of comparative fertility in animals, and thus be of importance in both medicine and farm animal production.

Another discovery made with the aid of colchicine settles the old question of what happens during gestation to the muscles of the uterus, which cradle the young during the pre-birth period. Professor Allen has definitely demonstrated that these muscles undergo great cell multiplication and growth. After birth, there must be a great dying off and resorption of this emergency tissue, returning the muscles to their ordinary size.

Warning has often been issued by physicians against too free use of female sex hormones in medicine, lest their highly active growth-promoting compounds run growth out of bounds into the wild, anarchic growth that is cancer. Professor Allen and his colleague, Dr. William Gardner, have found just that, as a result of long-continued stimulation of growth in the sex organs with hormones. He has slides showing the first experimentally induced cases of cervical cancer in animals. Such cancers can not be induced in all his animals, but they do arise in from fifty to sixty-two per cent. of the mice that survive hormone treatment for more than one year. Susceptibility seems to be partly a matter of heredity.

MUSCLE FIBERS

RUSSIANS are aiding American efforts in other fields than those of war. Basic research in life science, carried out at the Academy of Sciences in Moscow while Nazi bombers were nightly roaring over the city, has thrown new light on a problem under investigation by a biochemist working in New York. Dr. Kurt G. Stern, of the Overly Biochemical Research Foundation, at the annual symposium of the Society for the Study of Growth, reviewed present knowledge of how molecules grow and multiply.

Academician W. A. Engelhardt and his Moscow colleagues were trying to find out how muscle fibers used food energy in the contraction. The picture they got was one of a complex phosphorus compound, adenylpyrophosphate, being split by the contractile muscle protein. When they made an artificial model of muscle by spinning threads of muscle protein, much as artificial silk is spun, and immersed it in a solution of the energy rich phosphorus compound, the fibers lengthened. They see a muscle as a spring put under tension in this way. When a suitable stimulus is applied the coil snaps back, the muscle contracts.

This picture, said Dr. Stern, helped him considerably in his efforts to understand the growth and reproduction of the protein-like molecules of disease-causing viruses, those ultramicroscopic particles about which there is at present much dispute as to whether or not they are alive. Whether they are alive or not, Dr. Stern believes, is of less importance than a determination of the means by which they grow at the expense of their host cells.

One of the things that probably happens when virus particles multiply is a piracy of energy from the same kind of phosphorus compound in the host cell by the parasitic virus particles. It is suggested therefore that virus growth depends on the appropriation of the host cell's energy supply as well as its building material. This would explain, among other things, why viruses are always parasitic, feeding only on living cells of plants and animals, and are never found as scavengers, feeding on the dead. Dead things might yield them building materials, but could offer no substances actively engaged in the transfer of life energy.—FRANK THONE.

PUBLICATION OF A "LOST" BOOK

A GREAT encyclopedic work on the wonders of the New World, written by Fray Antonio Vásquez de Espinosa, long reckoned as one of the most famous of "lost books," has finally been published by the Smithsonian Institution. It really was lost for a long time—lost where it is hardest of all to find any particular book because it is surrounded by thousands of other books: lost in a great library. In this particular case it was the Vatican Library, where an American scholar, Dr. Charles Upson Clark, finally discovered the manuscript and the partially printed sections. It is at last available, in English translation, for anthropologists, historians, geographers and scholars of all angles of interest.

Fray Antonio, a very energetic, inquiring sort of person, spent the greater part of his adult life in South and Central America. He recorded everything he saw, quizzed missionaries, soldiers, officials, traders, and made judicious notes of all he learned. At last growing old, he went back home to write up and publish his tremendous accumulation of information. Unfortunately he died before much of his work got into print, and for three centuries scholars have known of his writings mainly through quotations by his contemporaries.

Fray Antonio made some mistakes in his accounts, especially where he was depending on the testimony of others. Like everyone else of his time, he describes California (which means Lower California) as an island. He also speculates on the location of the fabulous El Dorado, which has never achieved actual location on a map.

The book gives a rather good description of the American buffalo or bison, as "woolly, humpbacked cattle with two short horns twisted backward. . . . They are very ugly and wild. The wool on their chests in front is long and curly. They make excellent rugs from their hides." He also had a good word to say for the Indians of what is now the southwestern United States, speaking of them as "very intelligent and well-governed. They wear cotton clothing and antelope skins which are well decorated. As jewelry they wear turquoises."

ITEMS

CONTOUR plowing, following the natural levels of the land to conserve moisture and check soil erosion, is becoming increasingly popular on American farms. Until now, however, the old straight-line fences of the old square-shaped fields have remained, in many instances interfering with the curved path of the cultivating machinery and increasing the number of troublesome "point rows" necessary. Some farmers, according to the U. S. Department of Agriculture, have recently begun to reset their fences, so that field boundaries go with the contour plow lines. This not only abates the "point-row" difficulty, but furnishes a permanent guide to cultivation. Plant growth in the fence row also serves as a further water conserver and soil anchor.

NAVIGATION charts of the U. S. Navy will now appear in new colors. Studies conducted by the Navy show that the man who steps from a dark deck to a chart room illuminated by white or blue light will require from ten minutes to half an hour after he returns to the darkness before his eyes again become dark-adapted. This time required before he is able to see well in the dark is reduced to only a few seconds if the light used is red instead of blue. But when red lights and red goggles were introduced as a result of this study, it was found that the old colors on the navigation charts could no longer be distinguished. The buff color used for land, the orange which indicated navigational lights, and the red lines are all invisible under red lighting. So in future charts, the land areas will be gray, the lights will be magenta, and purple will be substituted for red.

AN all-time low record for smallpox in the United States was set in 1941, but health authorities of the Metropolitan Life Insurance Company warn against overconfidence about the smallpox situation. An increase in smallpox cases can confidently be predicted, they point out, if people generally get the false notion that vaccination against smallpox can be dispensed with. In that case the growing number of unprotected persons will provide a new fertile field for a resurgence of the disease. The shift, because of the war, of thousands of families of war workers from smallpox areas to cities previously free of smallpox may lead to outbreaks in these cities. The best protection against this danger is a wide-spread and vigorous campaign for vaccination, including revaccination of adults.

THE electron microscope now promises to show what happens to an individual disease germ when it is attacked by a germ-killing agent such as bichloride of mercury. The first studies along this line are reported by Dr. Stuart Mudd, of the University of Pennsylvania, and Dr. Thomas F. Anderson, of the RCA Manufacturing Company, in the *Journal of Experimental Medicine* for July. They find that when a typhoid fever germ is mixed with silver nitrate, the flagella which serve the germ as propellers are completely destroyed. The protoplasm, which is the very life of the cell, is stained black, but the wall of the cell is apparently unaffected. The entire germ is very much smaller, as if shrunken. When the typhoid fever germ is mixed with lead acetate, however, the flagella, though darkened, are not destroyed. The germ swells and its protoplasm escapes its wall to form a halo around it. Differences in action of lead, silver, nickel and mercury salts were also observed on cholera and dysentery germs and on a microorganism called Fusobacterium.

CHEMICAL magic with plants, written so that the ordinary garden variety of gardener can work it, is described by two U. S. Department of Agriculture plant physiologists, Dr. John W. Mitchell and Ruby R. Rice, in a new department publication, "Plant-Growth Regulators." It tells how growth-promoting substances, indole acetic acid and related chemical compounds, can be used to insure the rooting of slips and cuttings, to keep trees from dropping their fruit before it is ripe, to make holly berries form from unpollinated flowers, to induce the production of seedless tomatoes, and a number of other useful things that plants are unlikely to do if left to their own devices.

SCIENCE

Vol. 96 — Friday, September 11, 1942 — No. 2489

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

EDMUND BEECHER WILSON[1]

By Professor THOMAS HUNT MORGAN

CALIFORNIA INSTITUTE OF TECHNOLOGY

Edmund Beecher Wilson was born on October 19, 1856, at Geneva, Illinois. The first sixteen years of his life were passed there.

When Wilson was not quite sixteen his uncle Davis suggested that he take over the "little country district school" that his brother Charles had taught the year before. The offer was thirty dollars a month and board (with his aunt and uncle). "When the thermometer stood at thirty degrees below zero, as it did at times, this was, I assure you, no joking matter. I wonder how the modern city-bred youth would like such an experience. I had only twenty-five pupils or so, of all ages from six to eighteen, and I had to teach all grades, from the three R's up to history and algebra."

In the following summer he was in Geneva, where his cousin, Sam Clarke, had just returned from Antioch College. "As the summer passed I had gradually made up my mind to try for a college education and a life devoted to biology or at least to science." "I had nothing but my two hundred dollars and with this in hand I packed up my meager outfit in September and started for Antioch College in Southern Ohio." The college was a very simple one but with sound ideals. "We had good teachers. Here, for the first time I received regular instruction in zoology and botany, in Latin, in geometry and trigonometry

[1] Condensed from a memoir presented to the National Academy of Sciences.

and especially in chemistry with regular laboratory work, and I reveled in it all."

In June (1873) he went back to Geneva, where with a tutor he began to study Greek. Instead of returning to Antioch in the fall a new prospect opened. Sam Clarke wrote enthusiastic letters from the Sheffield Scientific School at Yale. "In turning towards Yale I was influenced not merely by Clarke's example but in part by the reputation of the professors of zoology, botany, comparative anatomy and geology, and in part by the almost equally compelling consideration to poor students that Yale offered many advantages in the way of self support. I felt, however, not yet fully prepared . . ." Wilson spent the winter with his family in Chicago in attendance at the university there, preparatory to Yale. Hearing of an opening as recorder in the Lake Survey he easily passed the examination, and was accepted at a salary of a hundred dollars a month. He took part in the primary triangulation of Lakes Ontario and Erie, which lasted until September; then he started east to enter Yale.

He entered the Scientific School at Yale in 1875 and graduated three years later with the degree of Ph.B. He remained there one year more doing graduate work and acting as assistant. During the first year at Yale he took courses in zoology with Verrill, in botany with Eaton and embryology with S. I. Smith. He then decided to regularize his work so that it would lead to the bachelor's degree. His three undergraduate years were, he writes, very busy and very happy years. At the end of the last year at Yale, Wilson was offered a position for the following year, but both Sedgwick, with whom he was on intimate terms, and Wilson himself were getting roseate reports from Sam Clarke, who was then at Johns Hopkins University. Both applied for fellowships there and were duly appointed.

At the end of his first year at Johns Hopkins both he and Sedgwick were reappointed to fellowships and in the third year to assistantships. His three years there opened a new world of ideals; he became aware, he says, of new horizons of research, and wider outlooks in biology. His teachers were H. Newell Martin and W. K. Brooks. It was with the latter that he carried out most of his own work. "It was through informal talks and discussions in the laboratory, at his house, and later at the summer laboratories by the sea that I absorbed new ideas, new problems, points of view, etc." "Through him I first discovered what I really wanted to do." "From him I learned how closely biological problems are bound up with philosophical considerations. He taught me to read Aristotle, Bacon, Hume, Berkeley, Huxley; to think about the phenomena of life instead of merely trying to record and classify them."

Wilson had more and more wished to study in Germany. At the end of the summer of 1882 he sailed to Liverpool. Newell Martin had given him a letter to Huxley, who expressed much interest in the work on Renilla. Later he arranged to have the memoir on Renilla published by the Royal Society.

Wilson settled down at Cambridge. Balfour had been killed in the Alps, but his assistants and students were there, and Wilson recalls meeting Adam Sedgwick, Heape, Caldwell and Bateson. He also met Michael Foster and attended his lectures. He returned to London to give his paper before the Royal Society and then left for Germany. After spending a few weeks in the small village of Thurm to familiarize himself with spoken German he went to Leipzig. Here he worked in Leuckart's laboratory and also attended a few of Ludwig's lectures on physiology. He introduced the section-cutting method that Caldwell had invented in England and it created a sensation. In Leipzig he heard a great deal of the best music.

Naples produced a deep and lasting impression on Wilson. The station came up fully to his expectations. There he came to know Anton Dohrn, with whom he formed a sincere friendship, Hugo Eisig, Edourd Meyer and Arnold Lang—names that are familiar to many American zoologists who have followed in Wilson's footsteps to Naples.

Sedgwick and Wilson had been much interested in the course in biology at Johns Hopkins given by Newell Martin, where in the laboratory the well-known book of Huxley and Martin was used. While at Williams they began planning along somewhat different lines a text-book of general biology. In part to carry out their plan of collaboration Wilson was offered a lectureship with Sedgwick at the Massachusetts Institute of Technology. The book appeared in 1885 and was very successful.

Bryn Mawr College, a new institution for the higher education of women, was to be opened in the fall of 1885 and Wilson was invited to take charge of the department of biology. The college had been founded by Quakers and from the beginning adopted a liberal, even advanced, policy in its educational aims. This policy was largely due to Miss M. Carey Thomas, who as dean and later as president introduced the same standards as those followed by Johns Hopkins. Wilson taught at Bryn Mawr from 1885 to 1891 and had wonderful success, attracting to his classes many of the ablest students in the college.

Henry Fairfield Osborn had accepted a call from Columbia to establish a new department of zoology. He offered Wilson the position of adjunct professor to cooperate with him in organizing the new department. The offer included an arrangement by which Wilson would be given a year of foreign study before

starting on his duties at Columbia. The second year in Europe was spent mainly in Munich and Naples and was even more productive and delightful than the first one, scientifically, because it settled definitely his later line of study, namely, cellular and experimental embryology. Boveri was at that time in Munich, and it was his presence there that had determined Wilson's choice of a place to work. Boveri was "far more than a brilliant scientific discoverer and teacher. He was a many-sided man, gifted in many directions, an excellent musician, a good amateur painter, and we found many points of contact far outside of the realm of science."

At the end of the year he went to Naples with the Norwegian Hjort as traveling companion. At the station he met Driesch and Herbst, both students of experimental embryology, which at that time was a relatively new field and to which Wilson was soon to make valuable contributions. Driesch's work on the experimental production of twins interested Wilson intensely, because of its bearing on his own work on the development of the earthworm and Nereis, then in press. In the spring of 1892 he went to Sicily to study the embryology of Amphioxus. Returning to Naples he sailed for Genoa, where he saw the famous Joseph Guarnerius violin of Paganini. "The thrill that it gave me was only equalled by my ascent of Etna."

In 1904 Wilson married Anne Maynard Kidder, the daughter of Dr. Jerome Henry and Anne Maynard Kidder. Dr. Kidder was a friend of Spencer F. Baird, who established the United States Fish Commission at Woods Hole. The Kidder family, who lived in Washington, D. C., built a summer cottage at Woods Hole and were on the most friendly terms with members of the Marine Biological Station. After the death of Dr. Kidder, Mrs. Kidder continued to go to Woods Hole. Many of us will remember her as charming, cultivated, witty and hospitable and she was regarded by us as much a member of our group as though an official member of it. It was at Woods Hole that Wilson first knew Anne Kidder, whose marriage to him added officially another valuable member of that family to the Woods Hole group. Their daughter, Nancy, Mrs. John Lobb, became a professional cellist of outstanding ability, and, during the latter years of Wilson's life, one of his greatest pleasures was watching her progress in her profession. This, in a sense, rounded off Wilson's passion for music.

Wilson's first extensive work, "The Development of Renilla," was published in 1883 in the Philosophical Transactions of the Royal Society, London. It was a splendid piece of descriptive work, admirably presented. The sixteen plates that illustrate the text are an example of his skill and taste in drawing.

During the six years he taught at Bryn Mawr College (1885–1891) he published a brief account of the movements of Hydra, and an extensive paper on the embryology of the earthworm (1889). After his appointment to Columbia University (1891) his research productivity steadily increased. In 1892 he published "The Cell-Lineage of Nereis."

The problem of the organization of the egg was an old one, but after the experimental work of Roux on frog's eggs and that of Chabry on ascidians' eggs, and the experimental work of Driesch on sea urchins' eggs, the theoretical deductions that they drew from these experiments, which were opposed, aroused wider and wider interest. From that time onwards the older phylogenetic problems lost interest, and embryologists took up the experimental study of embryology with increasing success and enthusiasm. Much of Wilson's later work was concerned with the evidence and its discussion in this new field.

In 1902 a graduate student, W. S. Sutton, pointed out that the two maturation divisions furnish an explanation of Mendel's laws. Wilson writes, "During the past year working in my laboratory he has obtained more definite evidence in favor of this result (the separation of maternal and paternal chromosomes), suggested by Montgomery (1901), which led him to the conclusion that it probably gives the explanation of the Mendelian problem." This conclusion of Sutton's has turned out to be more than "probable," and is to-day the basis for the mechanism of Mendel's two laws.

The most complete papers that Wilson published in 1904 deal with "Experimental Studies on Germinal Localization." The first deals with the egg of Dentalium; the second with Patella and Dentalium. These papers were the outcome of eight months' residence at the Naples Zoological Station in 1903.

Wilson's most outstanding contributions are his eight studies on chromosomes published from 1905 to 1912. These deal almost exclusively with the reduction divisions during spermatogenesis. Here accuracy of observation and care in interpretation of the behavior of the chromosomes are shown in a high degree. The actual counts of the number of chromosomes is in itself not difficult, at least in those forms that have a small number, and Wilson chose mainly such forms, but the changes that take place during the ripening of the sperm cells call not only for extraordinarily careful observations but also for skill in interpretation. In both respects Wilson was unusually gifted. None of his results has been rejected by later workers, while some of the erroneous chromosome counts of other contemporary cytologists held back for several years the solution of the role of the sex chromosomes in the determination of male and female.

In 1905 Miss Nettie Stevens at Bryn Mawr College

published in the Publications of the Carnegie Institution of Washington an account of the role of the sex chromosomes in the beetle Tenebrio. She showed that the male had 19 large and 1 small chromosome (the Y), the latter going to half the spermatozoa. She also showed that at the reduction division it (the smaller one) was the mate of one of the large chromosomes. Consequently half the ripe sperm had 10 large chromosomes and half had 9 large and 1 small chromosome. In the oogonial cells there were 20 large chromosomes which would reduce to 10 in the egg after maturation. She pointed out that an egg fertilized by a sperm with 10 large chromosomes would give a female with 20 such chromosomes, and that an egg with 10 large chromosomes fertilized by a sperm with 9 large and 1 small chromosome would restore the number characteristic of the male.

In the same year (1905) Wilson published a similar conclusion in regard to the role of the sex chromosomes in two other insects in which the female has one more chromosome than the male; thus *Anasa tristis* ♀ has 22, and the male 21; and Protenor ♀ has 14, and the ♂ 13. The Stevens type XX-XY and the Wilson type XX-XO are the same in principle. It has turned out that the former is much commoner than the latter as a sex-determining mechanism occurring widely in groups other than insects.

Five years after his appointment at Columbia University he published his book on "The Cell" (1896) which was at once recognized as the outstanding summary of the work in this field. Wilson drew upon his wide experience covering, as it did, the role of the cell in fertilization and development, in experimental embryology, in spermatogenesis, as well as thorough familiarity of the work of his contemporaries dealing with the cell. A third and greatly extended edition appeared in 1925. During the interval between the first and third editions, work in cytology had advanced in many directions and a voluminous literature had grown up. In a masterly way Wilson summarized this literature, separating the wheat from the chaff. I can not do better than quote here the words of Professor E. G. Conklin spoken at the time of the award to Wilson of the Daniel Giraud Elliot Medal (for 1925) by the National Academy,

"The third edition of 'The Cell in Development and Heredity' has been written out of this unique experience; it represents not only the mature point of view of the world's leading student and teacher of cytology, but it is to a large extent the work of its leading investigator in this field. Few other workers are left who were in at the birth of this science and who can speak of its development with the knowledge that comes from intimate contact with persons and problems, and no one could deal with this subject in a more comprehensive and judicial manner."

Wilson was a member of all the leading learned societies of Europe and America. He was a recipient of honorary degrees from the universities of Columbia, Harvard, Yale, Johns Hopkins, Chicago, Louvain, Cambridge (England), Lwow and Leipzig. He was awarded the gold medal of the Linnean Society, London; the Elliot Medal of the National Academy of Sciences; the John J. Carty Medal and Award. He will be lovingly remembered by his many friends as a reserved, cultured gentleman whose sincerity, judgment and breadth of knowledge were shown by the perfection of his lectures and his scientific papers.

WIND-WORN STONES IN GLACIAL DEPOSITS OF THE MIDDLE WEST

By Dr. LINCOLN R. THIESMEYER

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FOR many years the plains of the middle western States have been a classic area for studying deposits formed by the Pleistocene ice sheets. The preliminary work of mapping and distinguishing between sheets of debris spread during each successive episode of the Glacial Period is largely completed. In studies encompassing such vast areas many details will be overlooked, however, and left for the attention of later workers. This is not to the discredit of early investigators, for new data are commonly found each time a particular locality or rock outcrop is revisited.

One detail little noticed until recent years is the association with glacial deposits in central interior States of stones that were shaped, etched, modified or polished through abrasion by wind-driven sand. Such stones are common in modern deserts and have been found in many consolidated aeolian deposits, or "fossil deserts." Bryan[1] proposed the general name "ventifact" for all wind-scoured stones.

Hobbs[2] noted abundant ventifacts on barren plains bordering the Greenland ice-cap, where strong winds generated above the ice drive sand, silt and dust over stones too large for the winds to carry. Ventifacts

[1] K. Bryan, *Rept. Comm. on Sedimentation for 1929–30, Nat. Res. Coun. Cir. No. 98*, 1931, pp. 29–50.

[2] W. H. Hobbs, *Jour. Geol.*, 39: 381–385, 1931.

probably were formed under essentially similar conditions all over the glaciated tracts of the world. Bryan[3] has emphasized that arctic conditions favorable to formation of wind-cut stones must have prevailed during advance and retreat of Pleistocene glaciers in the Middle West. Many writers have described a profusion of wind-cut stones associated with glacial deposits in northern Europe and the northeastern United States, but there are few references to such stones in the north central States, and there is not enough descriptive information in most of these reports to indicate whether sand-blasting occurred during glacial or post-glacial time.

Bryan[4] suggested that ventifacts in glacial deposits of southeastern Massachusetts were formed at the surface and then churned underground by frost action, largely in early post-glacial time. He thinks this explanation may also apply to occurrences of ventifacts in other glaciated areas, in published accounts of which the probable date of sand-blast action[5] has not been indicated. The writer and others[6] reported ventifacts in place in undisturbed till and gravel deposits of the Cape Cod area well below depths affected by frost heaving. These authors consider, moreover, that most of the ventifacts were formed long before all the ice had disappeared from the region.

Wentworth and Dickey[7] listed several occurrences of ventifacts associated with glacial and post-glacial deposits of the Middle West, but for most of them it is not specified when the wind-sculpturing occurred. Recently Thiesmeyer and Digman[8] reported wind-cut stones embedded in drift of early (?) Pleistocene age. Previous to publication of that account there were, apparently, only two reports of ventifacts in the central United States known to have been formed *during* the Ice Age.[9]

Three new localities for wind-cut stones in Wisconsin and Michigan have been found during the past year. These are described below to bring the record up to date and to encourage other observers to supplement it. The writer believes systematic search will prove wind-scoured stones as common in glaciated country of the Middle West (and in the Driftless Area) as they are in New England. He suspects that most of them originated while the ice was close at hand, and that their emplacement *within* the deposits will prove related to factors other than frost action in the arctic climate peripheral to the glaciers.

Last spring the writer discovered well-formed ventifacts in a shallow roadcut about three miles east of Crystal Falls, Michigan, on State Highway M 69. The materials underlying this district are glacio-fluvial silts, sands and gravels. Inspection of the sand yielded half a dozen undoubted ventifacts from ¾ to 2 inches in diameter. Quartz, quartzite, granite and several types of porphyritic felsite were represented among the pebbles. It was not possible to determine whether these wind-cut stones had been formed at the surface in post-glacial time, because no clear signs of stratification could be seen in such a shallow roadcut. However, this additional example of ventifacts associated with materials of glacial origin stimulated search for localities where age relationships might be established. In discussion about the stones near Crystal Falls, Professor J Harlen Bretz, of the University of Chicago, disclosed that he had seen many ventifacts in the Baraboo area in Wisconsin. This helpful comment led to the finding of such stones at the third locality, described below.

Later several shallow roadcuts on U. S. Highway 141 four miles southeast of Crystal Falls were examined. Here the highway crosses a broad plain recognized easily as an outwash apron. The material exposed is well washed and sorted, medium to fine sand with occasional streaks of pebbles. Foreset bedding and channeling are evident at several places. A basketful of wind-shaped stones was collected here with little effort. They range in size from ½ inch to approximately 4 inches in diameter. The rock types include quartzite, coarse and fine varieties of granite, diabase, greenstone, red granite gneiss, conglomeratic quartzite and siltstone. Almost every type of wind-sculpturing effect previously observed on ventifacts is represented. Most of the stones were loose upon the slumped surface, but a few were gathered from undisturbed pebble layers several feet beneath the plain surface. This indicates both that they were deposited by glacial meltwaters after shaping in the sand-blast, and that there has been only slight overturning by frost action or plant roots at this locality since the ice disappeared. Some of the ventifacts show modification of their wind-carved features by abrasion during the later water transport.

The third locality is a roadcut 10 to 20 feet deep in till of the Wisconsin terminal moraine on U. S. Highway 12 approximately three fourths of a mile north of its intersection with State Highway 136. Here the moraine rises across a quartzite ridge on the northern boundary of the Baraboo basin. This locality, a scheduled stop on the itinerary of annual field trips to the Baraboo district conducted by several colleges and universities, has been visited by hundreds

[3] K. Bryan, *Am. Jour. Sci.*, 16: 162–164, 1928. (Review and discussion of an article by Paul Kessler.)

[4] K. Bryan, *Bull. Geol. Soc. Amer.*, 44: 176, 1932.

[5] K. Bryan, personal communication.

[6] L. R. Thiesmeyer, K. F. Mather and R. P. Goldthwait, *Bull. Geol. Soc. Amer.*, 50: 1939, 1939; F. E. Matthes, *Jour. Wash. Acad. Sci.*, 24: 195–196, 1934.

[7] C. K. Wentworth and R. T. Dickey, *Jour. Geol.*, 43: 97–104, 1935.

[8] L. R. Thiesmeyer and R. E. Digman, *Jour. Geol.*, 50: 174–188, 1942.

[9] Thiesmeyer and Digman, *op. cit.*, p. 175.

of people trained in geology, including the writer. Yet there is no published record of wind-worn stones here, probably because the visitors' attention was concentrated on more significant details of the deposit.

Close examination of this exposure in April, 1941, by the writer and a class of some thirty Lawrence College students revealed that many of the subangular stones are truly ventifacts. Scores of them were collected in a few minutes, mostly from the slumped surface; but random digging into undisturbed till below a shallow surface zone of weathering produced others. These ventifacts were evidently carried by the glacier in moving to its terminal position and then deposited in the morainic debris that now marks its former margin. Sand-blasting must have occurred earlier while the stones lay in a belt peripheral to advancing ice.

A white quartzite boulder 3½ feet in long diameter, extricated from till just beneath the moraine surface, was taken to the college museum. More than half its surface area bears shallow, subparallel cusps, grooves and flutings characteristic of many ventifacts, and these have a luster like Cellophane. Such surfaces are merely modifications of curving, conchoidal fracture faces commonly found on quartzite. Their arrangement shows clearly that the rock rolled into several positions during sand-blasting. The total amount of material removed by abrasion was apparently not sufficient, however, to give the whole stone a distinctive pyramidal or polygonal shape common among smaller ventifacts.

Most of the wind-carved rocks collected here are fragments of locally abundant Baraboo quartzite; but a few fashioned in coarse granite and felsite porphyry were observed. Consideration of rock types shown on the geologic map of Wisconsin shows that these stones were not transported far from their original positions of outcrop. Fragments of Potsdam sandstone widely distributed north of this did not withstand transportation and weathering sufficiently to retain the evidences of wind-sculpturing they may also originally have displayed.

In a region where surface rocks bordering and beneath the ice were friable quartz sandstones that yielded abundant sand to glacially generated winds conditions must have been especially favorable to formation of ventifacts. Consequently, it seems probable that glacial deposits of the Baraboo region contain a profusion of these curious stones.

The writer will welcome information concerning wind-cut stones at other places in the central States. He urges that the discoverer determine if possible: whether the stones occur within the deposit; at what depth beneath the surface; to what depth the material is stained by weathering; and whether the deposit is unlayered till or stratified sand and gravel.

Since observers trained in any branch of science may encounter these wind-worn stones, it appears worth while to list below other distinguishing characteristics of ventifacts.

(1) The wind-scoured surface is smooth, lustrous and has a rather greasy feel. The polish may vary from a dull mat finish to a gloss like Cellophane.

(2) The surface may be pitted, fluted, cusped or highly irregular through etching out of its less resistant portions. A wind-etched stone is distinguished from one produced by differential solution in weathering by smoothness and high luster of wind-eroded portions. Surfaces developed by solution processes are commonly dull, pitted and "chalky-feeling."

(3) Some ventifacts have distinctive polygonal shapes formed by carving of several rather flat facets across what were originally rounded pebble and cobble surfaces. These stones may be pyramidal, polygonal or shaped somewhat like a brazil nut. The shape attained depends on many factors, including: shape of original fragment, length of exposure to abrasion in one position, constancy of wind direction, resistance and texture of the stone, size of abrasive, mineral composition of stone and abrasive, number of times the stone rolled into new positions during sand-blasting, and amount of surface exposed to abrasion. Consequently, stones of almost any shape may bear evidence of wind-sculpture. Smoothness, greasy feel and high luster are the chief diagnostic things to observe on a surface that one suspects is a wind-cut facet.

OBITUARY

WILLIAM SCHAUS

1858–1942

THE death of Dr. Schaus on June 20 removed one of the last of the elder lepidopterists who have contributed most to our knowledge of the neotropical fauna. For over forty years he labored consistently and with unswerving devotion to one end, the building up of the most complete collection of tropical American Lepidoptera in the world, not for himself nor his personal profit but for the nation. He contributed generously to other institutions, notably the British Museum of Natural History, the Carnegie Museum at Pittsburgh and the American Museum of Natural History; but the bulk of his collection and his valuable library were given to the U. S. National Museum, and there he worked for the last twenty years of his active life. He described over five thousand new species, mostly from tropical America. With few exceptions

the types of these are deposited in the National Collection.

Dr. Schaus was born in New York City on the 11th of January, 1858. His father was the well-known art collector and dealer, William Schaus, Sr., proprietor of the Schaus Galleries, born in Germany and naturalized as an American citizen in 1854. His mother (born Margaret Connover) was from an old American family. Young Schaus was born to affluence and it was intended that he should carry on the business of his father. He received his early education at Exeter Academy and was sent abroad to finish his education in France and Germany. His principal training was in art, music and languages; but as a young man he came under the influence of Henry Edwards and found his real vocation. He decided, despite parental opposition, and at the sacrifice of a promising career as successor in his father's business, to devote his life to the study of Lepidoptera. He made his first collecting trip into Mexico in 1881. Thereafter he made frequent and extended trips with his companion and friend, Jack Barnes, to Mexico, Costa Rica, Guatemala, Panama, Cuba, Jamaica, Dominica, St. Kitts, the Guianas, Colombia and Brazil and collected over 200,000 lepidoptera. From 1901 to 1905 he lived at Twickenham, England. He visited England and the continent again in 1910 and in 1925 he again visited the continent and brought back the Dognin collection of tropical American Lepidoptera, purchased for the National Collection by funds which he had raised and to which he had contributed substantially. From 1919 until his retirement in July, 1938, he was on the staff of the Bureau of Entomology of the U. S. Department of Agriculture, first as specialist in Lepidoptera and later as entomologist. In 1921 he was made honorary assistant curator of insects of the U. S. National Museum. He was an honorary fellow of the Royal Entomological Society of London; fellow of the Zoological Society, London; honorary correspondent of the Société Entomologique de France; honorary member of the Entomological Society of Brazil; fellow of the American Entomological Society; fellow for life of the Metropolitan Museum of Art; member of the American Association for the Advancement of Science, of the Biological Society of Washington, and of the Entomological Society of Washington; corresponding member of the Philadelphia Entomological Society, and correspondent of the Academy of Natural Sciences, Philadelphia. In 1921 he received the honorary degree of master of arts from the University of Wisconsin and in 1925 that of honorary doctor of science from the University of Pittsburgh.

Few lepidopterists, even of his generation, have had such a wide and intimate knowledge of the world fauna as he. While his main interest centered in the American tropics, he worked with and described many Old World Lepidoptera. He was an accomplished linguist, a lover of art and music, a charming host and the most generous of friends. He was granted blessings that come to few of us, a long life in chosen labor, the satisfaction of completing that labor and a peaceful end.

CARL HEINRICH
EDWARD A. CHAPIN

U. S. NATIONAL MUSEUM

RECENT DEATHS

JOSEPH W. GAVETT, JR., professor of mechanical engineering and chairman of the department at the University of Rochester, died on August 28. He was fifty-three years old.

RAYMOND H. DANFORTH, professor of mechanical and hydraulic engineering and head of the department at the Case School of Applied Science, died on August 31. He was sixty-four years old.

DR. CHARLES E. CASPARI, dean and professor of chemistry emeritus of the St. Louis College of Pharmacy, died on June 11 at the age of sixty-seven years.

ELEANOR CATHERINE DOAK, professor emeritus of mathematics and a former chairman of the department at Mount Holyoke College, died on August 27 at the age of seventy-two years.

ARTHUR H. THOMAS, president of the Arthur H. Thomas Company, died on August 31. A correspondent writes: In 1892 he entered the employ of the old Philadelphia firm of James W. Queen & Co., dealers and makers of optical and scientific instruments. On December 8, 1900, Mr. Thomas organized the Arthur H. Thomas Company, dealers in laboratory apparatus and reagents, of which he was president. This company grew rapidly and has become one of the leaders in this field. He was deeply interested in education and at the time of his death was a trustee and director of Bryn Mawr College and a member of the Board of Managers of Haverford College. He was also a member of the Board of the Provident Mutual Life Insurance Company.

SCIENTIFIC EVENTS

THE ZOOLOGICAL SOCIETY OF LONDON AND THE NATURAL HISTORY MUSEUM AT SOUTH KENSINGTON

THE report of the Zoological Society of London for 1941 was presented at the annual meeting of the society on August 19. In an advance notice printed in *The Times*, London, it is stated that both Regent's Park and Whipsnade suffered several times

from air raids during 1940 and 1941. There were 11 incidents in all, eight in London and three at Whipsnade. Fifty-five high explosive bombs, 200 incendiaries and two oil bombs fell in the society's grounds. Although considerable material damage was done, there were no serious casualties among the staff or visitors, and very few among the animals. The number of visitors to Regent's Park in 1941 was 512,966, a decrease of approximately 119,000 compared with 1940, and the lowest figure since 1864. In spite of decreased traveling facilities the number of visitors to Whipsnade in 1941 was 246,139, an increase of approximately 43,000 compared with the previous year. The policy of the council is to keep Regent's Park and Whipsnade open and to preserve the bulk of the collections. Apart from the national service rendered by keeping places of healthy recreation available to fellows, war-workers, members of the armed forces and the general public, the council considers that this is in the best interests of the society in preparing for the speediest possible resumption of full activity after the war.

The Times also reports that the Natural History Museum at South Kensington reopened some of its galleries on August 1. It is stated that the parts of the museum which are reopening are all on the ground floor. They are the Central Hall, North Hall, Bird Gallery, Insect Gallery, Reptile Gallery and Whale Room. Visitors will not find all these filled with the exhibits they knew there in peace-time, since only things which could be replaced have been left on view. Nevertheless, many of the most popular exhibits, such as the great casts and skeletons of whales, the fascinating nesting groups of British birds and the series of domestic animals (dogs, cattle, horses, poultry, etc.) in the North Hall are still to be seen. British butterflies and moths are among the specimens in the Insect Gallery; and the Reptile Gallery now contains a miscellaneous collection, including a series of the British mammals. Another miscellaneous arrangement is that in the Central Hall, where many of the familiar peace-time features, for instance, the elephants and some of the groups showing protective coloring, remain. In addition, there are special exhibits illustrating the animals of the Libyan desert and some of the essential mineral ores. A large map of the world showing the sources of the most important minerals is another topical feature.

THE IMPORTANCE OF RESEARCH IN THE WAR EMERGENCY

THE following resolution concerning the importance of research in the war emergency was adopted by the Council on Research of the Pennsylvania State College on August 24:

In times of great stress such as confront the nation to-day there is a tendency to subject the activities of public institutions to rigid scrutiny and careful evaluation. Colleges and universities are not excepted in this desirable and necessary practice. In fact a periodic self-scrutiny and self-evaluation is helpful. Colleges and universities more than any other public institution must be living things. They, therefore, must not only be nourished, but from time to time, they must be pruned if they are to flourish and give forth bountiful and good fruit.

When the three functions of a great university are considered, there is a tendency in some quarters to look upon research as a luxury, to place it in the category of Sunday driving, pleasant, satisfying but unnecessary. This is unfortunate because the research ability and effort of its people constitute the greatest resource of the nation. The colleges and universities are the chief centers of training for research. As with the nation so with the college there is need for research activity at all times and under all conditions.

Great colleges and universities are measured not in terms of campus and buildings but in terms of human achievement. In the last analysis the accomplishments of the men and women that make up its faculty and students determine the greatness of such institutions. And it is in this respect that the spirit and activity of research are most important, for research is an intellectual vitamin which makes vigorous leaders of faculties. Education, when livened by research, is evocative, and curiosity and zest for discovery pervade the atmosphere of the classroom. Research cultivates a spirit of adventure and a desire in the student to explore the borders of knowledge. It is hard to see how teaching can be great without some contact with exploration of intellectual frontiers. Research and teaching by research constitute the nourishment by which universities are kept at the highest level in the service of the nation.

However, two other considerations are important in the evaluation of the research function of the Pennsylvania State College. One of these relates to the war effort. The war is as much a war of wits as of might, and mobilization of our inventive genius is of utmost importance. Colonel G. F. Jenks, of the Ordnance Department, U. S. Army, as chairman of Committee E–9 on Research, reported on research activities of the American Society for Testing Materials on June 24, 1942. His report reads in part as follows:

"Of course, our national research activities must be directed primarily to the development of implements of war, to improving our situation as to raw materials and transportation and to the development of superior processing methods. . . .

"The quantity of research personnel available is not readily expanded because of the training and aptitude required for successful work. The output of the country's research personnel can be increased through the utilization of agencies equipped to outline without delay logical research programs without unnecessary duplication of work and with a clear understanding of the problem. . . .

"There can be no question as to whether research is fundamental. The fundamental approach may consume

less time than less well-organized hit-and-miss methods. A fundamental knowledge assists both in the interpretation and application of research. It is especially needed in time of war when new untrodden fields must be explored. There can be no limitation fixed because of the time factor. It is beyond human power to predict when this war will end. It is certain, however, that cooperative research efforts directed to the ends of national policy will shorten the period of this world struggle.''

This recognition of the importance of research by the military authorities is further demonstrated by two recent official actions.

1. The Selective Service System through Occupational Bulletin 10, effective June 18, 1942, specifically provides for deferment of graduate students in a variety of critical occupations covering almost all schools of the college.

2. The U. S. Army in planning for the Enlisted Reserve specifically provides for a group of graduate students.

It is of course recognized that graduate students can not be trained effectively without experience in research.

The other factor is summed up in the statement that colleges and universities are the logical and perhaps the only remaining centers for freedom of search for truth. The torch of knowledge is in danger of extinction. To guard against such a catastrophe these institutions must foster the continued search for truth, must zealously protect the research function and must in every way possible support research effort.

The Council on Research submits that to-day as never before in the history of the Pennsylvania State College there is an urgent need for a vigorous research effort on the part of the faculty and that research must have the fullest possible support of the administrative officers and the Board of Trustees.

REPORT OF THE LIBRARIAN OF NEW YORK UNIVERSITY

THE Libraries of New York University are continuing to acquire a few scientific periodicals from the Axis-dominated countries of Europe, according to the annual report of Robert B. Downs, director of the libraries, which has now been made public.

The books are acquired under a recent decision of the U. S. Government and the British Ministry of Economic Warfare to permit American libraries to pay up to the sum of $250,000 for the purchase of journals which may be useful to the war effort. Since this amount is no more than a fraction of the sum ordinarily spent for European publications by institutions in this country, each research library has been allotted only those titles which it considers most essential to its needs.

The New York University libraries receive a highly selected list of periodicals in the fields of biology, chemistry, physics, geology and medicine from Germany, France, Denmark, the Netherlands and Italy. The subscriptions are purchased through dealers in neutral countries and are inspected by the British at Bermuda and by the United States customs officials at the port of entry before delivery to the university.

According to the report, so far there has been little evidence of political tampering in the areas of the pure sciences. This is naturally not true in the fields of the social sciences. Although in the physical sciences much material is obviously omitted if it may be of military importance, it is felt that enough articles of scientific value come through to compensate for the expense and trouble of obtaining the journals. Gifts and accessions are reported as follows:

The university libraries received gifts of more than 10,000 volumes valued at more than $75,000 during the past year. Notable gifts included a library of books on Judaica and Hebraica for the study of Jewish history, philosophy and religion from Dr. Mitchell Kaplan, and a collection of rare volumes in the same field from William Rosenthal.

The Fine Arts Library received several hundred books on art, including the files of a rare periodical devoted to the fine arts of Japan, from Robert Lehman, a member of the New York University Council; Dr. Moses Leo Gitelson established as a memorial to his brother, Raphael Gitelson, a special fund for the purchase of works in the field of American and British economic history; Henry B. Fernald presented several notable early editions in English literature, and Dr. Charles W. Gerstenberg presented an interesting collection of English and American literary annuals, or ''gift-books.''

Through a gift by Miss Margaret Barclay Wilson, the library purchased a collection of manuscript journals and letters of Henry Barnard, pioneer educational leader. The Society for the Libraries presented extensive microfilm collections of materials for the study of American culture, including reproductions of all known extant magazines published in the United States before 1800 and a collection of complete texts of 250 representative books about America beginning with 1943.

Mr. Downs states that in a recent survey by the American Library Association the collections of New York University had been rated "distinguished" in sixteen special fields: Classical papyri, German language and literature, French language and literature, French history (Huguenot), German history, French philosophy, Hegel, Jewish history and literature, sociology, education, international law and relations, economics, labor and industrial relations, meteorology, psychology and aeronautics. The survey covered a list of 75 subjects and the nation's libraries were rated in those fields by 500 scholars and other authorities. Mr. Downs also reported that the U. S. Office of Education and the New York State Education Department had named New York University as a War Information Center.

MATHEMATICIANS AND THE WAR

THE following cablegram has been sent to SCIENCE from Dr. A. Kolmogorov, a member of the Academy of Sciences of the USSR at Moscow:

All trials of the patriotic war which our country is waging against Hitlerism haven't stopped the intensive work of Soviet mathematicians. In Moscow and in all other towns mathematical research institutes are working full speed, lectures are being delivered at universities, scientific societies are meeting, mathematical journals are being printed.

Many young Soviet mathematicians are bravely fighting German vandals at the front. Nevertheless they keep in touch with science. In the last issues of *Doklady* of the Academy of Sciences, USSR, several notes have been printed by W. Smulian, "Acting Red Army," which he has written at the front. The last works by D. Raikov were written in the hospital where he was recovering after having been wounded at the battle of Moscow in the autumn of 1941.

The number of mathematicians that are working at mathematical war problems necessary for defense of our country increases daily. Stalin prizes were assigned in 1941 to mathematicians Christianovitch and Kelych for works on aerodynamics connected with problems of plane structure. Many mathematicians who had formerly devoted themselves to the purely abstract domains of our science—number theory, mathematical logi, topology, functional analysis—are now steadily working on problems of aerodynamics. Many of our well-known mathematicians are working at military plants and artillery polygons. We are full of admiration for the splendid and productive work of American mathematicians in all branches of our science. We are enchanted with the careful, irreproachable issues of English mathematical journals throughout all the terrible air raids, but we are especially satisfied when we read in the *Bulletin* of the American Mathematical Society that American mathematicians are beginning to concentrate their attention on war problems. All the future of our splendid science and the fate of humanity depend now on success in the struggle against war, and, in the first place, against German aggression. The sooner the aggressors are crushed, the sooner shall we mathematicians be able to meet at our next international congress and freely renew our peaceful work.

IN HONOR OF HENRY GRANGER KNIGHT

THE American Institute of Chemists has passed the following resolution in honor of Henry Granger Knight, past president of the institute.

WHEREAS, We, the National Council of The American Institute of Chemists, Inc., have learned with deepest sorrow of the death of our associate and friend, Dr. Henry Granger Knight, and

WHEREAS, Dr. Knight as a teacher has imbued many young men with an enthusiasm for chemistry and an appreciation of its importance to humanity, and

WHEREAS, as Chief of the Bureau of Chemistry and Soils, now the Bureau of Agricultural Chemistry and Engineering of the United States Department of Agriculture, he has been of inestimable value to the agricultural industry of the United States and through it to every American citizen, and

WHEREAS, as President of The American Institute of Chemists, he gave evidence of his interest in the individual chemist as a medium for the advancement of successful civilization, and

WHEREAS, in recognition of his noteworthy and outstanding service to the science of chemistry and the profession of the chemist in America, The American Institute of Chemists, Inc., did bestow upon him its annual medal, and

WHEREAS, his high sense of honor, his upright character and his clear judgment will ever be an inspiration to us, and

WHEREAS, his lovable nature, his cheerfulness, and his kind and thoughtful qualities will ever be remembrances of his friendliness,

Therefore, be it Resolved, that the Council of The American Institute of Chemists, Inc., hereby records its lasting appreciation and deep sense of loss of one who has been a true friend of chemists; and that our sympathy be extended to his family; and that a copy of these resolutions be spread upon the minutes of the National Council of The American Institute of Chemists, Inc.

SCIENTIFIC NOTES AND NEWS

DURING his visit to Mexico, Peru, Chile, Argentina and Uruguay from February to August, 1942, Dr. George D. Birkhoff, Perkins professor of mathematics at Harvard University, attended the inaugurations of the Observatories at Tonantzintla, Mexico, and Busque Allegre in Argentina, as delegate, and gave lectures on mathematical, physical and philosophical topics in a number of universities in these countries. He was incorporated formally as honorary member of the faculties of the National University of San Marcos at Lima and of the University of Chile, and received the degree of doctor, *honoris causa,* at the University of Buenos Aires. He was also made a corresponding member of the National Academy of the Mathematical, Physical and Exact Sciences at Buenos Aires, and was incorporated as honorary member of the Peruvian Philosophical Society, of the Scientific Union of Argentina and of the Mathematical Society of Argentina.

RALPH W. FREY, research chemist of the U. S. Department of Agriculture, has been given the W. K. Alsop Award by the American Leather Chemists As-

sociation for "outstanding research work advancing the art of the science of leather manufacture."

DR. B. H. WILLIER, professor of zoology and chairman of the Division of Biological Sciences at the University of Rochester, was elected president of the Society for the Study of Development and Growth at the recent meeting of the Society at North Truro, Mass.

PORTRAITS of Dr. William S. Carter, formerly professor of physiology and dean of the Medical School of the University of Texas, and of the late Dr. Harry O. Knight, formerly professor of anatomy, have been presented by the University of Texas Medical Alumni Association to the University of Texas Medical Branch at Galveston.

PROFESSOR HENRY EYRING, of Princeton University, will join the staff of the department of chemistry of the Polytechnic Institute of Brooklyn during the coming academic year as visiting professor of physical chemistry.

THE retirement is announced of Dr. Hugh A. McGuigan, since 1917 professor of pharmacology and therapeutics at the University of Illinois College of Medicine.

DR. DONALD SLAUGHTER, formerly associate professor of pharmacology of the College of Medicine of Baylor University, has been appointed professor of pharmacology and physiology and chairman of the department of the College of Medicine of the University of Vermont.

AT Iowa State College, Professor Joseph K. Walkup, of the University of Pittsburgh, has been appointed head of the department of general engineering, and Professor E. L. Barger, of the University of Arkansas, has been named professor of agricultural engineering. Professor Fred Beard, of the department of animal husbandry, has resigned to take a position in charge of the meat-grading service of the Agricultural Market Administration. Buford McClurg has been made research assistant professor. He will succeed Professor Beard as meat specialist at the college.

DR. ALBERT E. DIMOND, plant pathologist at the Connecticut Agricultural Station, has become assistant professor of botany at the University of Nebraska. Dr. Alfred John Wakeman, who for thirty years has been engaged in chemical research at the station, retired this summer.

DR. M. NOBLE BATES, instructor in histology and embryology at Cornell University, has been appointed associate in histology and embryology at the Jefferson Medical College, Philadelphia.

PROFESSOR MADISON BENTLEY has returned to Cornell University (Morrill Hall, Ithaca, N. Y.) as lecturer in psychology. Besides instruction and research, he will edit and publish *The American Journal of Psychology*, relieving Captain K. M. Dallenbach, who has entered active service in the Plans and Training Branch of the Adjutant General's office.

DR. LOUIS ROUND WILSON has retired after serving for ten years as dean of the Graduate Library School of the University of Chicago. Dr. Wilson, who is sixty-five years old, plans to return to the University of North Carolina, with which he was associated for thirty-one years before he went to Chicago. The Graduate Library School, established by a grant of the Carnegie Corporation and the only Graduate School in the library field, is largely due to the work of Dr. Wilson.

DR. HOMER L. DODGE, director of the new research institute and of the school of engineering physics and dean of the Graduate College of the University of Oklahoma, has leave of absence to permit him to assume on September 15 the directorship of the office of scientific personnel of the National Research Council. He succeeds Dr. J. C. Morris, who will return to his post as professor of physics at Tulane University to supervise a special electronics training program. The office of scientific personnel will continue to assist the army, navy and other war agencies in obtaining competent scientific staffs. It will continue to cooperate with the Selective Service Headquarters, the Office of Education and other agencies in the conservation, training and effective use of technical manpower in the war effort.

PROFESSOR WALTER MUMFORD, chairman of the department of forestry of the College of Agriculture of the University of California and forest economist of the Giannini Foundation, has been appointed first honorary adviser of the National Bureau of Forestry Research of the Republic of China.

WILLIAM H. BAYLIFF, formerly assistant professor of biology and later tutor at St. John's College, Annapolis, Md., has been appointed executive secretary to the Maryland Board of Natural Resources.

DR. T. C. RUCH, of Yale University, and Mrs. Judith Wallen Hunt, of the Bio-Medical Libraries, University of Chicago, have been added to the section editor group of *Biological Abstracts* as editors of the amalgamated Section of Biography, History and Bibliography.

DR. HAROLD L. HANSEN, of Northwestern University, consultant to the Federal Food and Drug Administration, the Federal Trade Commission, the Council on Pharmacy and Chemistry, and secretary of the Council on Dental Therapeutics and director of

the Bureau of Chemistry of the American Dental Association, has been appointed administrative assistant to the president of Winthrop Chemical Company, Inc.

DR. C. M. HARING, professor of veterinary science in the University of California College of Agriculture, has been appointed consultant to the War Manpower Commission.

COLIN CAMPBELL SANBORN, curator of mammals at Field Museum of Natural History, has been commissioned a lieutenant (senior grade) in the U. S. Navy, and Frank Boryca, assistant preparator in the department of botany, has enlisted in the U. S. Marines.

DR. ROBERT G. BERNREUTER, professor of psychology at the Pennsylvania State College, has been granted a leave of absence to accept a major's commission in the U. S. Army Specialists' Corps. He will act as field supervisor of thirty-five national army centers for specialist training of personnel men.

THE Committee of the British Privy Council for the Organization and Development of Agricultural Research has appointed Professor James Gray and Professor F. L. Engledow members of the Agricultural Research Council in succession to Sir Merrik Burrell and Professor D. M. S. Watson, whose terms of office as members of the council have expired.

G. E. FRIEND, medical officer to Christ's Hospital, Horsham, England, has become the honorary general secretary of the British Food Education Society.

THE annual symposium of the Division of Physical and Inorganic Chemistry of the American Chemical Society will be omitted this Christmas because of world conditions.

THE *News Letter* of the American Association of Scientific Workers states that a provisional program has been arranged by the symposium committee (Drs. Shapley, Elliott and Sandow). Four sessions are planned. The first is to take place on Tuesday afternoon, December 29. The subject is "Scientific Research in the War Effort." A meeting on "Scientific Cooperation Between the United Nations" is planned for the evening, with speakers from the various United Nations, perhaps with a wide radio hook-up. The first session of Wednesday, December 30, will deal with "Science in the War of Production" and the final session, in the afternoon, will be a joint session with the National Association of Science Writers on "Morale and Propaganda."

IN view of the scarcity of qualified persons to fill such positions, the Civil Service Commission has issued in revised form its continuously open examinations for technical assistants and junior physicists. For junior physicist ($2,000) the requirements are: completion of a 4-year college course including 18 semester hours in physics. Applications will be accepted from senior students who expect to complete the required courses within six months after filing applications. The technical assistant ($1,440–$1,800) examination contains three optional branches: engineering, metallurgy and physics. For the $1,800 grade, three years of college study is required; for the $1,600 grade, two years; and for the $1,440 grade, one year. Provision is made for the acceptance of technical assistant applications from those who have not completed the required three, two or one year of college study but who expect to complete the required courses within four months after filing applications. Appropriate war-training courses may be substituted for college hours required in any optional branch. There are no age limits for these examinations. No written tests are required. Applications will be accepted until the needs of the service have been met. Applications are not desired from persons engaged in war work unless a change of position would result in the utilization of higher skills possessed by the worker. Announcements and application forms may be obtained at any first- or second-class post office or from the Civil Service Commission, Washington, D. C.

THE *Journal* of the American Medical Association reports that Lankenau Hospital Cancer Research Institute will receive nearly $2,000,000 from the estate of Mrs. Anna C. Burr, who died on March 6. The bequest, which will be used for the study of cancer, will serve as a memorial to Mrs. Burr's husband, Edward H. Burr, who died in 1922.

"ALDERSEA," the Bar Harbor, Maine, summer residence of Miss Mary Robert Coles, who died on October 22, 1941, has been given by her heirs to the Roscoe B. Jackson Memorial Laboratory, the cancer research center at Bar Harbor. The buildings will provide office space for the staff and distinguished visiting investigators, part of the library, space for important experimental work and for scientific meetings.

THE sum of $3,908,310 was collected for the control of infantile paralysis during the national celebration of the President's birthday last January. The expenses of the committee were $207,889 or five per cent. of the amount raised. The *Journal* of the American Medical Association states that New York led the states with contributions of $663,646, California was second with $337,318, Pennsylvania third with $329,684, Illinois fourth with $202,352 and Ohio fifth with $202,236. Theaters raised $1,338,059. Half the proceeds goes to the National Foundation for Infantile Paralysis, whose share is used to sponsor clinical and laboratory research on the disease, provide epidemic aid, and conduct an educational program for both the general public and the medical profession.

The other fifty per cent. remains with the state and county chapters of the foundation, where it is used to provide direct medical assistance to infantile paralysis patients, regardless of age.

By executive order of President Roosevelt, ten fish and wildlife preserves have been established in New York counties. The Department of the Interior will have jurisdiction over these areas and they will "be reserved as refuge and breeding grounds for native birds and other wildlife and for research relating to wildlife and associated forest resources." The land required for the sanctuaries will remain available to the State of New York for use and management by its conservation department, under the custody of the Fish and Wildlife Service of the Department of the Interior. The preserves in New York Counties include Schuyler and Tompkins, Chautauqua, Allegany, Allegany and Livingston, Ontario and Yates, Oswego, Jefferson and Madison, Delaware and Albany.

William L. Batt, deputy chairman of the War Production Board and president of SKF Industries, Inc., of Philadelphia, made the address of welcome at the presentation of the Army-Navy Production Award (the Army-Navy "E") to the Leeds and Northrup Company on September 5. Admiral Henry A. Wiley, U. S. Navy retired, was the Navy's official spokesman and presented the "E" pennant. It was received by C. S. Redding, president of the company, and J. L. Johnson, president of the Employee's Association. Lieutenant Colonel Thomas H. Stilwell, Commanding Officer of the Eastern Pennsylvania District, was the Army's official representative at the ceremonies.

DISCUSSION

ANOMALIES OF COLOR VISION

The article by Miss Murray on "Color Blindness and Borderline Cases" (Science, August 7, 1942), is an excellent exposé of the present confusion in regard to what is popularly called "color-blindness"; but in our opinion the revelation is not sufficiently comprehensive.

For twenty years we have been finding persons who fail on the chart tests (pseudoisochromatic tests), of Stilling, Ishihara, *et al.*; but who in all practical situations distinguish colors as well as do the persons called "normal" in color vision; and who have no difficulty with worsted tests and other practical tests. We have found others who pass the chart tests without difficulty, but who show serious defects of color vision in practical life and in real tests.

The reason for this apparent discrepancy is made apparent by the chart tests themselves. These tests usually include one or more charts which can be read by "color-blind" persons, but which can not be read by many who are considered as "normal." This is a paradoxical situation which should impress even a layman. The reading of the charts is assumed to depend on ability to distinguish the colors of which the numbers are made up from the colors of the background (the surrounding spots). Here, however, are charts which the person who is supposedly "normal" can not read, whereas a person who is presumably unable to distinguish the color reads them! The conclusion that the charts do not test color perception is inescapable.

Reading of the numbers in the charts requires that there shall be a difference in appearance between the numbers and the background. Obviously, the difference is not in hue. Actually, a difference in brightness is required; and if the numbers do not differ appreciably from the background in brightness, they can not be discerned. Even among persons classed as "normal," the relative brightness of colors of low saturation (low intensity of the chromatic factor) varies from individual to individual. In other words, some have a slightly higher threshold for certain colors than do others. Spots of small area (such as the spots composing the numbers in the charts), which appear to one person brighter or darker than the other spots composing the background may, to another person, be so little different in brightness that the numbers can not be read. On the other hand, spots which to the average person appear brighter than the background may appear to a really "color-blind" person darker than the background spots; and conversely, spots which to the average person appear darker than the background may appear to certain individuals darker than the background. In either case, the individual with abnormal color thresholds can read the charts easily, although he may be defective in practical color vision. It is obvious that in the charts the "normal" person can not read, the figures and background are nearly alike in brightness; whereas for the person (color-blind or not) who reads them, there is a brightness difference.

The facts above epitomized have long been known to psychologists, and have even been slowly percolating into elementary psychological texts. They have been ignored by promoters of chart tests and by those who have used them in routine work, because the chart tests can be applied rapidly by persons devoid of training in the psychology of color perception. The valid tests available up to the present time take time and

require an expert to use them. The extensive use of the chart tests in the present war emergency has brought sharply to public attention the fact that these tests are not only unfair, but are also unsafe. It would actually be safer to discard color tests altogether.

That there is some correlation between color thresholds and ability to distinguish colors at normal intensities may be admitted, although the amount of correlation is as yet undetermined. About 80 per cent. of persons who have flunked chart tests have been able, after use of Vitamin A in adequate quantities for an adequate period, to pass these tests. It is suspected that those who become normal for practical purposes, but still fail on some of the charts in a chart test are suffering from dietary insufficiency of protein; but this is not certain.

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THE USE OF GENERIC NAMES AS COMMON NOUNS

A GENERIC name is always a collective noun. It may be masculine or feminine or neuter, but it is always in the nominative case and it is always singular in number. It should be italicized and the first letter should be capitalized. A specific name is always a modifier of the generic name which it follows. It usually is an adjective, but it may be a noun in the genitive case or in apposition with the generic name. It must agree with the generic name in gender and number, and it should be italicized but not capitalized. Examples: *Paramecium caudatum, Amoeba dubia* (specific names, adjectives); *Paramecium calkinsii, Pelomyxa carolinensis* (specific names, nouns in the genitive case); *Amoeba proteus, Felis leo* (specific names, nouns in apposition with the generic names).

A generic name refers to all the individuals which are similar to the type specimens of the genus, and a specific name to all those which are similar to the type specimen of the species. Generic and specific names can therefore not be used to refer to a single organism or to a number of organisms smaller than the total number in the genus or species. To refer to a given number of individuals belonging to a species, *e.g.*, *Amoeba proteus*, it is necessary to designate the number under consideration and add "specimens of," *e.g.*, "a specimen of *Amoeba proteus*," or "the, some or × specimens of *Amoeba proteus*." There is no such thing as an *Amoeba proteus*, or an *Amoeba* or the *Amoeba* or some *Amoebae* if the name is italicized and the initial letter is capitalized.

I have found that in some work it becomes very burdensome to use "specimen of" or "specimens of" every time I wish to refer to a given number of individuals belonging to a genus. I have consequently obviated this by using the generic name as a common noun, *e.g.*, an amoeba or some amoebae, without italics or capitals. If generic nouns are used as common nouns there obviously is no more justification for capitals and italics than there is in the use of other common nouns, *e.g.*, cat or cow. This procedure not only avoids excessive use of a cumbersome phrase but it also saves considerable space without any reduction in clarity and precision of meaning, provided the species is known. Wouldn't it be a nuisance if we had to use the phrase "male specimens of *Homo sapiens*" in place of "men" every time we refer to two or more human beings! Imagine an orator beginning his address with "female and male specimens of *Homo sapiens*" in place of "ladies and gentlemen"!

Some assert that it is "vulgar" and "illegitimate" to use generic names as common nouns, but no one, so far as I know, has ever maintained that it is either vulgar or illegitimate to use common names for organisms, *e.g.*, men and cats. I fail to comprehend why the use of a generic name, as a common name, should be considered more vulgar and illegitimate than the use of any other noun. Is it less vulgar, less refined, less common to call, *e.g.*, specimens of *Homo sapiens* "men" than it would be to call them "homines" and specimens of *Felis domestica* "cats" than it would be to call them "feles"? Moreover, a generic name as a common name has some outstanding advantages, for it at once indicates the genus to which the organism belongs, and is readily understood by foreigners as well as by natives. Is it not obviously more illuminating to call, *e.g.*, a specimen of *Chilomonas paramecium* a "chilomonad" than it would be to call it a "carbo" or some other common name?

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THEORIES AS TO THE ORIGIN AND NATURE OF LIFE

IN a recent number of SCIENCE,[1] Dr. A. L. Herrera published what is termed "a new theory of the nature and origin of life." An essential preliminary to the enunciation of any theory as to the origin and nature of life must be a statement of the criteria whereby the existence of a living unit may be established.

While there are difficulties in drawing a very sharp line of demarcation between living and non-living,[2] many, perhaps most biologists will accept the criteria of Alexander and Bridges[3]—self-duplication and the ability to direct chemical change by catalysis. The

[1] A. L. Herrera, SCIENCE, 96: 14, July 3, 1942.
[2] J. Alexander, "Colloid Chemistry," 4th ed. (New York, 1937).
[3] J. Alexander and C. B. Bridges, "Colloid Chemistry, Theoretical and Applied," Vol. II, pp. 9–58 (New York, 1928).

simplest conceivable living unit would thus be a molecubiont—a catalyst particle of molecular dimensions, capable of autocatalysis (self-reproduction). The ability to undergo heritable changes is generally observed in living units, and seems to be a third criterion of life, although we can conceive of units incapable of this basis of evolution. Heritable changes in biocatalysts (demonstrated in the case of genes but probable also with enzymes, carriers and prosthetic groups), underlie changes in chemical output due to synthesis and analysis, which in turn are the basis of changes visible in structure, form, physiology and function.

It has long been known that many of the phenomena developed by and in living units may be simulated by non-living systems. Traces of colloidal substances may cause crystallizing material to assume beautiful flower- or fern-like forms. "Colloidal gardens" have long been used as lecture demonstrations, and may be grown by dropping, *e.g.*, a crystal of copper sulfate into sodium silicate solution. "Enzoon," long thought to be a relict of early life, may be nothing but a Liesegang ring formation. Besides the interesting artifacts described by Dr. Herrera in his note above referred to, he has mentioned and illustrated many others in his paper on "Plasmogeny,"[4] and in the same book Professor Stéphane Leduc (Nantes) in a paper on "Solutions and Life" has described and illustrated similar work of his own. Petrologists (*e.g.*, Sir J. S. Flett) have described and simulated dendictic and margaritic forms found in rocks, and window-pane ice often shows beautiful plant- and flower-like tracery.[2]

Although these various artifacts may simulate many of the forms and activities of truly living units, none of them has as yet been shown to exhibit the criteria of life above outlined, which, on the other hand, are all shown by the smallest known bionts (genes, viruses, bacteriophages). Since the same physico-chemical forces and principles dominate both living and non-living units, it seems reasonable to believe that life originated by the chance formation of an autocatalytic unit of molecular dimensions; for the smaller its size, the greater the probability of its formation. Ultramicroscopic bionts which might develop now would have small chance of surviving to form a new race, because of the great number and variety of predatory forms of life now existing. And conditions existing when the first life emerged must have been quite different from present conditions on the earth. Very few living units can even now synthesize their necessary molecules from the "bare rocks," but are largely dependent upon molecules furnished by other bionts. Food thus has an important evolutionary biochemical aspect, and there is truth in the dictum: "Rien n'est la proie de la mort; tout est la proie de la vie."

JEROME ALEXANDER

NEW YORK, N. Y.

[4] A. L. Herrera, pp. 81–91, and S. Leduc, pp. 59–79, "Colloid Chemistry, Theoretical and Applied," Vol. II.

QUOTATIONS

THE WOODS HOLE MARINE BIOLOGICAL LABORATORY

THE meetings of the Corporation and Trustees this year were of special significance for they mark the end of Dr. F. R. Lillie's long and fruitful service as an active officer, and the beginning of Mr. Riggs's term as president. Dr. Lillie came to Woods Hole as a beginning investigator in 1891. Nine years later he was made assistant director, and after Dr. Whitman's death in 1908, he became director. During the years that followed, this institution, under his guidance, grew rapidly in prestige and in size. When the extensive building program, which gave us the Brick Building, the Dormitory and the Apartment House, was completed in 1925, he retired as director and was made president of the corporation, a position which he has held until now. Thus, he has seen the laboratory grow from infancy to maturity, and during the intervening years has played a very large part in shaping its policies. It is our good fortune that he will continue to work here and advise those who in the past have relied on his sound judgment and foresight.

To succeed him the trustees named as president Mr. Lawrason Riggs, for the past eighteen years our treasurer. The precedent of having a non-biologist in this position was set many years ago when Mr. C. R. Crane, the generous patron of the laboratory, was chosen. The office of vice-president was created, and was filled by the election of Dr. E. Newton Harvey, professor of physiology at Princeton. Mr. Donald Brodie was made treasurer. He is not a stranger to Woods Hole. For many years he was associated with Mr. Crane, and thus became familiar with the affairs of the laboratory. Dr. Otto Glaser was elected clerk of the corporation in place of Dr. P. B. Armstrong, who resigned. These officers assume their new responsibilities at a critical time. We are confident that under their leadership this institution will continue to serve its primary purpose of encouraging biological research, and will maintain its prestige.

The trustees elected eleven new members of the corporation and named Dr. Glaser and Dr. Metz to serve on the executive committee. The corporation reelected all the trustees whose terms of office expired

this year, and elected Dr. Eric Ball and Dr. Eugene F. DuBois to fill the places of Dr. A. P. Mathews and Dr. S. O. Mast, who were made trustees emeriti. Finally, Dr. Lillie was elected president emeritus.

Mr. Riggs, as treasurer, reported that the laboratory is free from indebtedness and has a small reserve fund. The director showed, by means of charts, how the annual income has dropped in the last two years from $170,000 to $130,000. To balance the budget, the executive committee has been forced to make drastic cuts in the appropriations for many of the departments, particularly for research and for the library. While it is true that we can not now buy much apparatus nor receive and pay for foreign journals, we shall presently have to expend considerable amounts for both of these essential items of our equipment.

Dr. Little explained how apparatus now must be repaired and altered to serve new needs, and emphasized the fact that investigators must adapt themselves to these unwelcome conditions. The librarian, Mrs. Montgomery, spoke of the microfilm service which is now in operation. Already it is extensively used. Indeed, we soon may be unable to fulfill all the requests for films.

In the present conditions, it is difficult, if not impossible, to predict the future. But we must assume that next year, research and instruction will continue here at Woods Hole. In the fifty-five years of its existence, this laboratory has maintained these activities without interruption. Every effort will be made to keep them in full operation.—*Dr. Charles Packard, director of the laboratory, in The Collecting Net.*

SCIENTIFIC BOOKS

MATHEMATICS

Mathematics—Its Magic and Mastery. By AARON BAKST. New York: D. Van Nostrand Co., Inc. 1941. $3.95.

To Discover Mathematics. By GAYLORD M. MERRIMAN. New York: John Wiley and Sons, Inc. 1942. $3.00.

Mathematics and the Imagination. By EDWARD KASNER and JAMES NEWMAN. New York: Simon and Schuster. 1940. $2.75.

To tear from mathematics the veil of misconception which obscures it in the popular mind and to reveal it in aspects as antithetical as may be to the cramped or forbidding ones of the elementary schoolroom is a quest which is currently calling forth a swelling volume of literary effort. The reading public is no longer a stranger to prospectuses and prefaces which beckon with promises of easy and painless instruction in the ways and uses of numbers, or which give voluble assurances of a ready entrance into the temple where the beauties and sublimities of mathematics lie revealed, and where all may grasp the grandeur and boldness of its harmonies and symmetries or of its all-pervading utilities. Mathematics, one is assured, is ineradicably ingrained in human thought and achievement. *Ipso facto* some modicum both of understanding of its subject-matter and appreciation of its essence is no less than a *sine qua non* of the educated and cultured man. To supply these desiderata the proffered volumes exist.

As must be, different readers will differently appraise the success which crowns each specific effort. The mark aimed at is high—perhaps too high. Poor and friendless thing though the more standard mathematical textbook may be, it is certainly no parvenu. Its claims of ancestry go back to Euclid often with much more justice than to the name which graces its title page, and over its evolution both savants and pedagogues have labored much. However popular it may be to eschew it, its earmarks will assert themselves, whenever the mere discourse about mathematics yields to any actual presentation of theory or fact. By the same token, the extant body of truly significant mathematical ideas was not easily come by. It was, on the contrary, a halting accretion, the crystallization of inordinately sustained and groping effort. There is small evidence that we are brighter than were our ancestors. It seems a far cry, therefore, from the great Gaus' misgivings as to the wit of the "Boethians," to the ostensibly easy confidence with which many present-day writers essay upon the exposition of abstract and basic ideas to any tyro, if he will but think.

Of the volumes here specifically under review, that which makes least demand upon previous knowledge is "Mathematics—Its Magic and Mastery." Written in an engaging style, and amply supplied with figures and entertaining vignettes, approximately one half of the book's 790 pages are designed largely for amusement. This is the magic of it. Easy discussions of the elementary arithmetic processes are flavored with parlor tricks, with examples of the coincidences which attach to combinations of numbers appropriately adjusted to their base of notation, with interesting visualizations of large numbers or very small ones, with puzzles, codes, etc. This will entertain all who enjoy the manipulation of numbers or who delight in the manifold disclosures of curious and unexpected regularities. In the later pages the domi-

nance of theme passes to the mastery. One meets there, in conjunction with appropriate applications, with progressions, logarithms, exponentials and probabilities, with geometry—plane, solid and analytic, with trigonometry, ballistics, etc. The inexperienced reader will find the going here slower. Upon occasion he will understand better the author's statement: "There was a time when mathematics was regarded as an intricate subject," than he will the assertion: "Fortunately, this day is long past." More experienced readers may learn less, but will enjoy more. There is much here wherewith the more sober presentations of ordinary textbooks can be supplemented and enlivened.

"To Discover Mathematics" is, for all its intentionally informal style, a didactic rather than an entertaining volume. Though chapters may be headed in such manner as: "The Fountain Head," "Magic of the Mind," "Declaration of Independence," etc., these superscriptions, in fact, refer to discussions of elementary algebraic and number theoretic matters, of geometric methods, synthetic or analytic, of logarithms and exponentials, or of trigonometry and the calculus. Professedly the book is designed to expose the utility and beauty of mathematics through the use of elementary but significant material, and to this profession it adheres with considerable success. This reviewer would recommend this book to many an advanced college student. Such will find it easy—perhaps in spots a trifle tedious—but may draw from it on the whole a rewarding synthesis of many disparate topics.

The proclaimed mission of "Mathematics and the Imagination" is "to extend the process of haute vulgarization to those outposts of mathematics which are mentioned, if at all, only in a whisper; which are referred to, if at all, only by name; to show by its very diversity something of the character of mathematics, of its bold, untrammeled spirit, of how—as both an art and a science—it has continued to lead the creative faculties beyond even imagination and intuition." The reader will find here clever discussions of the possibilities of largeness in numbers and of smallness, of the finite versus the transfinite, of the limiting process, of analytic geometry (to n dimensions), of Euclidian and non-Euclidian geometries, of mathematical pastimes and paradoxes, of probability, topology and the calculus (to space filling curves, and curves without tangents). It goes without saying that with a program so broad the discussion is far from exhaustive, nor was it the intention that it should be so. Lest the reader regard the subjects as too profound, the author gives incidental assurances to the effect that the "high and mighty mumbo jumbo" in terms of which they are usually couched, is wholly dispensable, since "High priests in every profession devise elaborate rituals and obscure language as much to conceal their own ineptness as to awe the uninitiate." Even in the face of such an exhortation, one might still hold that the mathematically sophisticate will glean more from this book than will the novice. For those already in possession of some outlook in mathematics and who wish either to broaden it, or at least to militate against its ossification, this book is wholly recommendable.

The authorship of books such as these is a laudable and withal no simple task. Of the beauties and essentials of mathematics a few, to be sure, are easily accessible. For a proper appreciation, however, even these frequently demand a deeper understanding. By and large, what lies near the surface of the subject belongs much more often among its trivia than among its profundities. The navigable literary channel between the Scylla of unintelligibility and the Charybdis of tediousness, is thus prevailingly narrow. Is it surprising, therefore, that the discovery of a royal road to mathematics is not yet to be signalized? That is, perhaps, after all, a hopelessly Utopian vision.

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SPECIAL ARTICLES

THE INORGANIC CONSTITUTION OF BONE

Throughout the last century there has been active discussion regarding the inorganic constitution of bone. Analyses show that the principal constituents are calcium, phosphate and carbonate with minor amounts of magnesium and sodium. Bone gives an x-ray diffraction pattern similar to that of the mineral apatite, the unit of structure of which contains $Ca_{10}(PO_4)_6F_2$. Various substitutions, such as $(OH)^-$ for F^- and Mg^{+2} for Ca^{+2}, are known to occur in the apatite lattice without producing significant changes in the diffraction pattern.

Suggested formulas for the phosphate compound of bone and their latest proponents are: $Ca_5H_2(PO_4)_4$, Berzelius (1845); $Ca_{10}(PO_4)_6CO_3$, Gassman (1937); $Ca_{10}(PO_4)_6(OH)_2$, Klement (1938); a neutral compound containing carbonate, Logan (1938); $(Ca,C)_{8-9}[(P,C)O_4]_6Ca(OH)_2$, Gruner, McConnell and Armstrong (1937).[1] In the last formula carbon is present not only in hypothetical $[CO_4]^{-4}$ groups but also as C^{+4} ions replacing Ca^{+2} ions.

[1] References are to be found in recent review articles; C. Huggins, *Physiol. Rev.*, 17: 119, 1937, and S. Eisenberger, L. Alexander and W. D. Turner, *Chem. Rev.*, 26: 257, 1940.

Possibility of carbonate substitution in the apatite lattice was summarily demonstrated by McConnell and his coworkers.[1] We now find that this substitution, unlike the *one suggested* by these authors, involves replacement of $3(PO_4)^{-3}$ groups by $4(CO_3)^{-2}$ groups with accompanying changes, such as Ca^{+2} replacement by Na^+, in the positive ions to maintain balance of charge. The manner in which this possibly takes place is shown in Fig. 1 (A) and (B).

Tricalcium phosphate prepared from solutions also has an apatite type structure giving a diffraction pattern closely similar to that of bone and thus must be considered. This compound, the existence of which is questioned in almost all the literature on the subject, can readily be prepared in crystalline form as shown by the electron microscope; a convenient method of preparation being hydrolysis of $CaHPO_4 \cdot 2H_2O$ in solutions more acid than pH 5.0 at 100° C. Its limiting formula appears to be $Ca_3(PO_4)_2 \cdot 2/3H_2O$ and the water is unusual in that much of it is held to 600° C. In this respect the compound resembles the silicate mineral apophyllite[2] in the lattice of which water probably is split into H^+ and $(OH)^-$ ions as required by Pauling's electrostatic valence principle. The apatite-like unit of structure of tricalcium phosphate hydrate contains $[Ca_9](PO_4)_6(H_2O)_2$ which perhaps is better written as $[Ca_9(H^+)_2](PO_4)_6(OH)^-_2$. A probable way in which these substitutions take place in the apatite lattice is shown in Fig. 1 (C) and (D). The phosphate of this compound can be partially replaced by carbonate as in other apatites.

The neutral or basic character of the inorganic compound is ascertainable by accurate analysis of properly prepared samples of bone. Unfortunately, most analyses have been carried out on bone from which organic matter was removed by methods which would result in hydrolysis of a neutral compound. Many other analyses of bone show an apparent excess of positive ions due to incomplete recovery of phosphate.[3,4]

Trustworthy analyses,[5,6,7] with the magnesium and sodium determinations of Klement,[8] indicate that the average composition of the unit of structure for the apatite compound of human bone is near

$$[Ca_{8.80}Mg_{0.25}Na_{0.19}][(PO_4)_{5.07}(CO_3)_{1.34}](H_2O)_{2.6}$$

[2] W. L. Bragg, "Atomic Structure of Minerals," Ithaca, pp. 226 *ff*., 1937.

[3] C. M. Burns and N. Henderson, *Biochem. Jour.*, 29: 2385, 1935.

[4] A. E. Hoffman and P. Caldwell, *Jour. Assoc. Official Agr. Chem.*, 25: 206, 1942.

[5] M. A. Logan, *Jour. Biol. Chem.*, 110: 375, 1935.

[6] C. M. Burns and N. Henderson, *Biochem. Jour.*, 30: 1207, 1937.

[7] J. Marek, O. Wellmann and L. Urbanyi, *Zeit. f. Physiol. Chem.*, 226: 3, 1934.

[8] R. Klement, *Naturwiss.*, 26: 145, 1938.

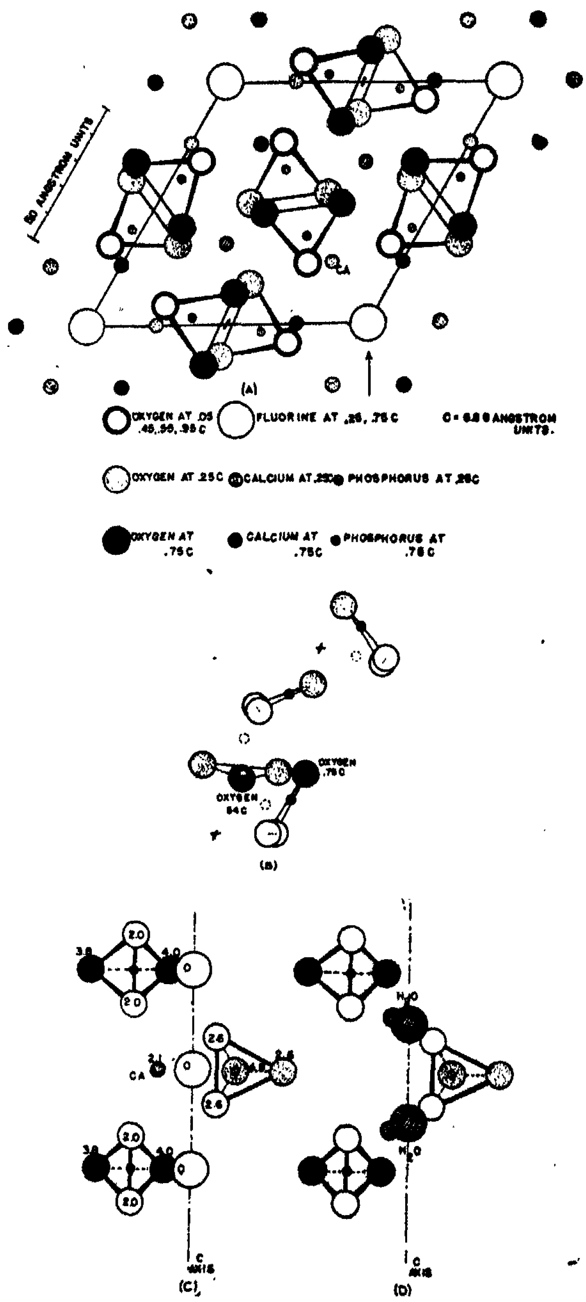

FIG. 1: (A) Projection of the apatite structure on the basal plane. Since each PO_4 group has one edge parallel to the c axis two oxygen atoms of a group are superimposed and the group thus appears as a triangle. (B) Projection parallel to the c axis showing a way in which $4CO_3^{--}$ groups can replace $3PO_4^{---}$ groups. Relationship of this projection to (A) can be seen by superimposing the plus marks. (C), (D) Projection of a portion of the apatite structure on (10.0) [along the arrow in (A)] showing the manner in which Ca^{++} and $2F^-$ are replaced by $2H_2O$ or $2(OH)^-$ and $2H^+$ ions. Distances in angstrom units from the projection plane are indicated.

Sodium, of course, may replace Ca^{+2} ions on account of similarity in ionic radius and to an extent that de-

pends upon the Na^{+} concentration in plasma. Limited analytical results from the literature indicate that dentine, while still a hydrated tricalcium phosphate, differs significantly from bone in having a possibly higher Mg^{+2} and lower $(CO_3)^{-2}$ content. Its average formula approaches

$$[Ca_{8.90}Mg_{0.46}Na_{0.16}][(PO_4)_{5.84}(CO_3)_{0.86}](H_2O)_{2.0}$$

Enamel on the other hand is a more basic compound and a representative sample of human enamel has the formula

$$[Ca_{9.40}Mg_{0.18}Na_{0.11}][(PO_4)_{5.67}(CO_3)_{0.46}](OH)_{1.84}(H_2O)_{0.46}$$

which approaches that of a carbonate hydroxyapatite.

Possible variation in the basicity and composition of the inorganic compound of bone with type, species, age and pathological condition, although the subject of many studies in the past, can only be ascertained by further extensive analyses in which the errors of past work are avoided and in which the minor but not unimportant sodium and magnesium are determined. In general, evidence now available would seem to indicate that bone contains a hydrated tricalcium phosphate type of compound instead of hydroxyapatite as widely accepted and that sodium and carbonate are essential constituents of this compound.

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OCCURRENCE OF AVIDIN IN THE OVIDUCT AND SECRETIONS OF THE GENITAL TRACT OF SEVERAL SPECIES

AVIDIN, the anti-biotin factor which produces egg-white injury, has hitherto been known to exist only in the white of the hen's egg.[1] The site of origin and physiological significance of this potent biological substance have remained obscure. The white of the hen's egg represents a secretion from the mucosal lining of the oviduct.[2] Since the translucent jelly-like secretion found adherent to frogs' eggs is the direct homologue of the white of the bird's egg, it was deemed advisable to determine whether avidin might be present in this secretory product of the frog oviduct as well as in the oviduct itself. In addition, the oviduct of the hen and the eggs of several other species of birds were also assayed for avidin.

The materials to be tested were obtained in the fresh state, spread on glass plates and dried in a current of warm air at 37° C. The dried preparations were then pulverized and assayed for avidin by the yeast-growth method of Eakin *et al.*[3]

It was found that avidin exists in readily demonstrable quantities in the oviduct of both the hen and wood frog (Table I). It is noteworthy that the egg-jelly from two different species of frogs also contains very considerable anti-biotin potency. The presence of avidin in the egg-white of all the species of fowl tested should also be noted.

TABLE I

AVIDIN CONTENT OF BIRD AND AMPHIBIAN TISSUES AND SECRETIONS

Species	Material assayed	Units* of avidin per gm. dried weight
Hen (New Hampshire)	Egg white	11.5
	Oviduct	2.3
	Intestine	0.0
Wood frog (R. sylvatica)	Egg jelly	1.7
	Oviduct	0.75
	Intestine	0.0
Pickerel frog (R. palustris)	Egg jelly	1.5
Turkey	Egg white	16.2
Duck	" "	7.1
Goose	" "	8.0

* A unit of avidin is that amount required to completely neutralize the yeast growth supported by one microgram of free crystalline biotin.

Dried intestine of the hen and of the frog was employed as a control tissue and was found to contain no demonstrable activity.

The relatively low titres found in the oviduct of the hen and of the frog may be accounted for by the fact that the muscularis and stroma of these organs contribute a considerable proportion of inert material to the assay.

These data suggest that avidin is a secretory product of the oviduct of birds and amphibia and therefore may play an important role in embryonic development and in the physiology of the genital tract.

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HEREDITARY TRANSMISSION OF INDUCED TETRAPLOIDY AND COMPATIBILITY IN FERTILIZATION

THE writers have reported[1] that the change to a tetraploid condition ($4n=28$ chromosomes) induced by colchicine in the branches of self-incompatible diploid ($2n=14$ chromosomes) plants of *Petunia axillaris* (Lam.) B. S. P. was accompanied by a change to self-compatibility in fertilization and seed formation. It may now be reported that further investigations show that the condition of self-com-

[1] P. Gyorgy, *Annual Review of Biochemistry*, xi: 337, 1942.

[2] B. Patten, "Embryology of the Chick." P. Blakiston's Son and Co., Inc., Philadelphia. 1929.

[3] R. E. Eakin, E. E. Snell and R. J. Williams, *Jour. Biol. Chem.*, 140: 535, 1941.

[1] A. B. Stout and Clyde Chan[illegible] ...ents' 94: 118, 1941.

patibility was transmitted to all seedlings thus far obtained from the selfed flowers of tetraploid branches and also that there was compatibility for all cross-relations among each series of these seedlings.

A total of 212 plants were grown from seeds obtained by controlled self-pollinations of eight flowers on tetraploid branches. The seedlings obtained from each capsule were pedigreed and numbered in a series. Three series were from different capsules of the same plant. *Each of the other five series was from a different plant.*

All seedlings of selfed tetraploid branches were tetraploid. All had the several characters which differentiated the tetraploid branches from diploid plants and branches. The corollas of the flowers, the anthers and the stigmas were definitely larger. There was appreciable increase in size for a maximum of about 50 per cent. of the pollen grains of a plant and these had four germ pores instead of three, which is the typical condition for diploid plants of this species. For the tetraploid plants whose pollen was examined the abortion of pollen ranged from 15 per cent. to 50 per cent. The chromosome numbers for 45 of the seedlings were determined; all were tetraploid. Thus all seedlings obtained from tetraploid flowers were tetraploid, which indicates that in the self-fertilizations of the tetraploid flowers only pollen and egg cells that were diploid had functioned in seed production.

All the tetraploid seedlings were self-compatible. Each of these plants was tested by controlled self-pollinations. Every one was highly self-compatible to its own pollen. *Only one seedling produced small* capsules to self-pollination, the largest of which had 65 seeds. Except for this plant there was no evidence of a partial selective incompatibility that results in reduced seeding.

The tetraploid seedlings of a series were cross-compatible in all intra-cross-relations. For one series of 44 siblings all possible cross-pollinations between 20 plants were made and six of these plants were used both as pollen and as seed testers with the other 24 members of the series. Similar tests were made for each of the other seven series of plants to a total of approximately 2,000 cross-combinations. In each and every one of these cross-relations large capsules well filled with seed were obtained.

Of back-cross-relations only those of tetraploid seedlings *x* diploid parent were cross-incompatible. Both diploid and tetraploid branches of each of several of the original plants which were treated with colchicine were propagated as clones and used in various cross-pollinations with their own tetraploid seedlings [illegible] 226; [illegible] Naturwiss.

(1) A parent tetraploid clone as a seed parent with any of its tetraploid seedlings as a pollen parent was cross-compatible for every one of the 54 combinations that were tested.

(2) A parent diploid clone as a seed parent with any of its tetraploid seedlings as a pollen parent was cross-compatible for every one of the 130 combinations tested.

(3) Of the 142 cross-combinations tested for tetraploid seedlings *x* a parent tetraploid clone, every one was *highly compatible.*

(4) Tetraploid seedlings were tested as seed parents in 213 different combinations with the parent diploid as a pollen parent and in every case there was complete incompatibility.

Studies in pollen-tube behavior were made which revealed that:

(1) in all combinations which involve the pollen of tetraploid flowers the more advanced pollen tubes grew rapidly and reached the ovary within 48 hours after pollination.

(2) in self-pollination of self-incompatible diploid plants the pollen germinated but the more advanced tubes grew so slowly that at the end of six days none were observed more than three-fifths of the distance from stigma to ovary.

(3) in the cross-pollinations with tetraploids the pollen grains of a parent diploid germinated and grew at approximately the same rate as when used in self-pollination.

The results reported above were fully definite and conclusive for the material studied. The condition of induced tetraploidy eliminated the self-incompatibility that operated in the diploid somatic parent. This condition was transmitted to all the tetraploid recombinations of genetic factors which were obtained in each of the seed progenies. Also among the members of each progeny there was complete cross-compatibility for at least some one of the classes of pollen that segregated from the tetraploid complex. In back-cross relations the only incompatibility that continued was when the haploid pollen of a self-incompatible parent was used to pollinate a pistil of the tetraploid offspring. In the diploid plants of *Petunia axillaris* there is genetic control[2] in the relations of fertilization which effects self- and cross-incompatibilities. But when these genetic factors were duplicated in tetraploid branches and in their seed progenies there was no longer expression in respect to seed production of either self-incompatibility or intra-sib cross-incompatibility.

A. B. STOUT
CLYDE CHANDLER
THE NEW YORK BOTANICAL GARDEN

[2] A. B. Stout, *The Botanical Review*, 4: 275–369, 1938.

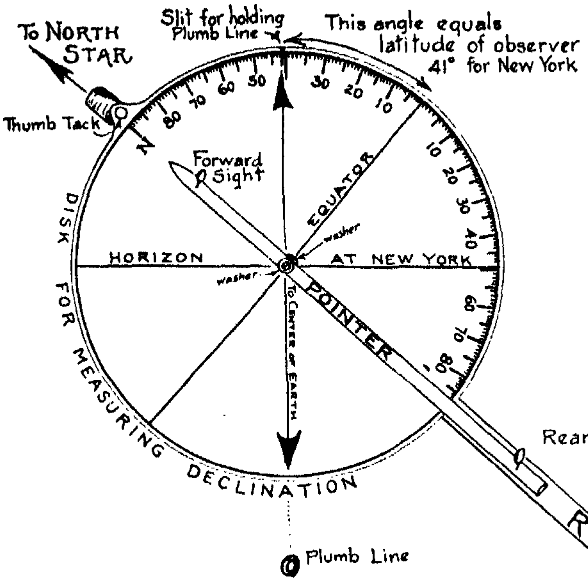
SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE STUDENTS' ASTROLABE

The device which I am about to describe has been employed for several years in teaching a part of the general science course to students in Columbia College. It is used in the astronomical part of the course to introduce the conception of the celestial sphere and is designed for outdoor observations. Aside from the fact that it well serves the purpose for which it was made it has several other attributes to commend it, namely: it is sufficiently inexpensive so that each student can have his own instrument; it is made of readily available materials so that almost any student can make one for himself; it provides a tool for astronomical observation available to inexperienced students who could not personally handle the expensive and intricate instruments of the observatory; it requires accuracy of technique just within the range of the undergraduate level (that is, for the non-scientific students notoriously lacking in manual dexterity); and finally it offers a means for introducing scientific observation and reasoning into matters of daily occurrence. This last function is in fact the main purpose of the whole course.

The instrument in question is called the students' astrolabe. Its principle is that of the telescope with equatorial mounting, but instead of a telescope there is only a pointer. In action the astrolabe makes use of a knowledge of right ascension, declination, sidereal time, altitude of the North Star, latitude, ecliptic and Vernal Equinox. The accompanying illustration hardly needs an explanation except to point out the fact that by means of the tripod the instrument can readily be set up so that the long rod, or right ascension axis, can be pointed at the North Star. This is done by sighting through the eyelets on the pointer, which is first set in the position shown. The declination disk is securely fastened to a flattened side of the long rod, the lower end of which passes through the right ascension disk and rests on a hole bored in the tripod head. The small indicator close to the right ascension disk is set in a plane parallel to the declination disk.

The simplest way to use the instrument is to take it out at night and point it directly at the North Star, a feat readily accomplished by adjusting the tripod legs. If the North Star is not visible because of clouds, buildings or too much light, the instrument



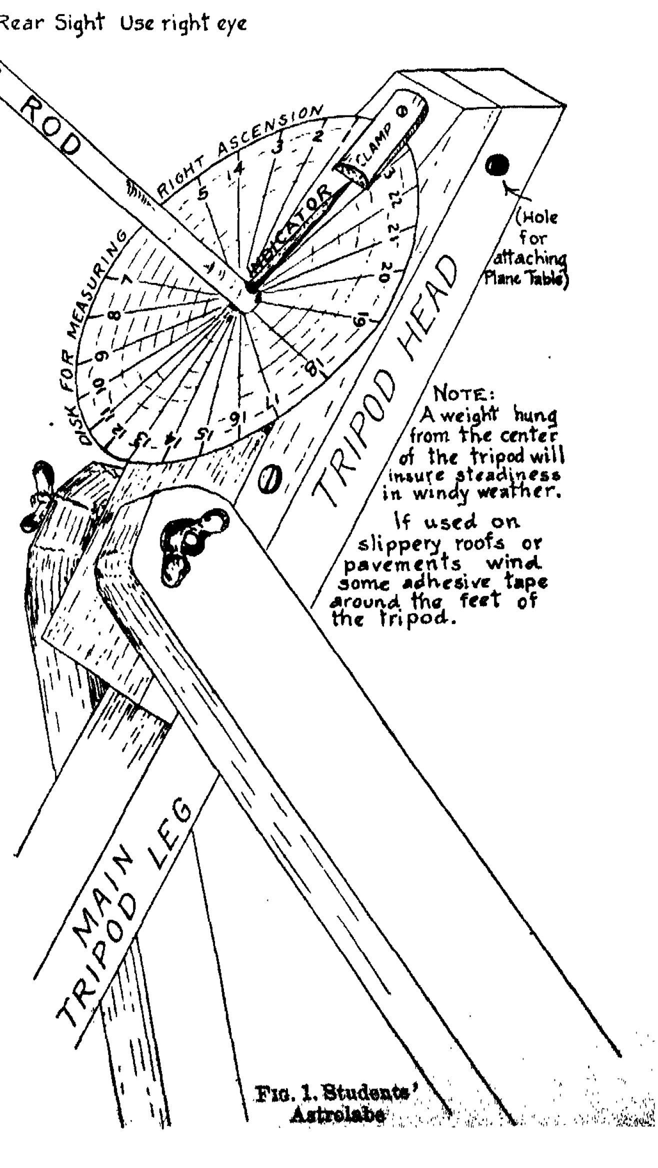


Fig. 1. Students' Astrolabe

may be accurately placed by orienting it with a magnetic compass with due allowance for compass declination, and by using a plumb bob to get the right slant, as suggested in the picture for a station in the latitude of New York. The plumb bob consists of a small weight supported by a thin thread which is held in a slit on the degree mark on the declination disk corresponding to the latitude of the place.

The next adjustment is to turn the right ascension disk to its proper position. This is the same as rectifying a celestial globe. The easiest way to do this accurately is to turn the pointer and also the rod on its axis so as to sight upon some known star whose right ascension may be learned from the Nautical Almanac or from a star map. Then turn the right ascension disk until the proper hour mark is opposite the indicator, in which position it should be temporarily clamped. The instrument may now be used in two ways: (1) To identify unknown stars sight upon the unknown star with the pointer, read its declination and right ascension, and then identify it from its position on a star map; (2) To make an original map of the sky, plot on a blank sky map the observed positions of stars and constellations whose actual names, however, may be unknown. The original map may later, with much pleasure, be compared with an authentic map.

One of the most interesting uses we have made of the astrolabe is to set it up in the daytime, rectifying the right ascension disk by using the tables for sidereal time on the first pages of the Nautical Almanac and then adjusting the pointer so that it will be directed at a certain star to appear some time that evening several hours later. The instrument is then left untouched until that time has arrived. As we have a battery of these astrolabes available, different students are able to set up the instruments in order to view different stars at different later times.

Daytime use of the astrolabe is especially instructive because the North Star is not visible. From the Nautical Almanac tables we set up the instrument to point at the moon, which often as not is below the horizon. Then we determine what phase the moon is in and the hour of rising or setting. These conclusions are later checked either by direct observation or by reference to the almanac, thus giving practice in the use of that valuable and interesting book.

On two occasions we have set up the instrument at midday and directed it at the location of Venus, whose position was obtained from the almanac. Then by careful scrutiny we were able to observe Venus by the naked eye at high noon in a brilliant summer sky. This perhaps indicates the accuracy with which celestial bodies can be located. We found that it is quite possible to measure the right ascensions and declinations of the three stars in the belt of Orion which are perhaps only a degree or two apart.

Other kinds of observations readily suggest themselves, such as locating the position of a planet in the sky (be it either above or below the horizon) by using the right ascension and declination figures given in the almanac, and from this determine the planet's configuration which can then be checked against the almanac tables.

Night-time studies of the invisible sun as well as daytime and night-time studies of the invisible moon suggest problems by which the times of sunset and sunrise as well as moonset and moonrise may be determined, this being accomplished by turning the right ascension rod so that the pointer is directed toward the western or eastern horizon and making the other necessary observations and adjustments.

It is possible also to set up the instrument for any point on the earth's surface and from the almanac tables giving right ascension and declination of the sun and moon determine the time of sunrise and sunset, and moonrise and moonset at any latitude on any date. These results can be compared with other almanac tables.

We venture to believe that simple, home-made apparatus of the type described may be used to wean the students away from the idea that scientific thinking can be done only in the midst of test-tubes and elaborate equipment. Courses in general science are presumably designed to inculcate a habit of scientific thinking in matters of all kinds and for that reason the use of readily made instruments is to be encouraged as such devices are available at all times. It should be remembered that the vast majority of students taking courses in general science, after they leave school, never have access to factory-made laboratory apparatus.

If we learn that this short account proves to be of interest to other science teachers we may have the temerity to describe one or two other simple things that we have done along these lines.

A. K. LOBECK

COLUMBIA UNIVERSITY

BOOKS RECEIVED

ABRAMSON, HAROLD A., LAURENCE S. MOYER and MANUEL H. GORIN. *Electrophoresis of Proteins and the Chemistry of Cell Surfaces.* Illustrated. Pp. 341. Reinhold Publishing Corporation. $6.00.

BIRKELAND, JORGEN. *Microbiology and Man.* Illustrated. Pp. x + 478. F. S. Crofts and Co., New York. $4.00.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE BUFFALO MEETING OF THE AMERICAN CHEMICAL SOCIETY

CHEMISTRY'S contributions to the American war effort was the keynote of the annual fall meeting of the American Chemical Society which opened last Monday, with 4,000 of the country's leading chemists gathered to hear and discuss something over 400 papers setting forth the gist of the year's progress.

"National Survival Through Science" was the subject of the presidential address, delivered Monday evening by Professor Harry N. Holmes, veteran of the Oberlin College faculty. More particular treatment of special topics at the daily sessions included papers on such war-important subjects as synthetic rubber, gasoline and oil, alloy steels, dehydrated foods, synthetic plastics, potash and the newer chemical drugs.

There were many men well known in industry and public affairs as well as in the field of chemistry among the participants in the program. The list included Lieutenant General William S. Knudsen; Dr. Charles M. A. Stine, vice-president of E. I du Pont de Nemours and Company; Dr. Willard H. Dow, president of the Dow Chemical Company; Dr. Edward R. Weidlein, director of the Mellon Institute in Pittsburgh, and many others.

Chemistry's equivalents of Distinguished Service Medals were awarded at the meeting. The Francis P. Garvan Gold Medal, honoring women in chemistry, was presented to Dr. Florence B. Seibert, of the Henry Phipps Institute of the University of Pennsylvania, for her distinguished work on the chemistry of tuberculosis. For contributions in the field of protein chemistry, Dr. John L. Oncley, of the Harvard Medical School, will receive the $1,000 American Chemical Society Prize in Pure Chemistry, given annually for outstanding research by a man or woman less than thirty-six years old.

One feature that usually marks meetings of the American Chemical Society was this year conspicuously absent: there were no inspection trips to industrial plants where chemical methods are in use. This year, and for the duration, such visits are impossible because of wartime restrictions that bar even scientists from factories where production is being pushed to the utmost and even the visits of colleagues would be a time-losing distraction. Instead, parties of the chemists and their wives made trips to nearby Niagara Falls.

VANADIUM, strengthener of steel for war, is now being extracted by a new process from Idaho phosphate rock used in fertilizer manufacture. It is estimated that half a million tons of vanadium can be recovered from the 5,700,000,000 tons of phosphate rock in sight in this deposit. The extraction process was described before the meeting of the society by Dr. J. Perry Morgan, chemical engineer of the Standard Oil Company of New Jersey, who developed it under the direction of Professor Arthur W. Hixson, of Columbia University.

The phosphate rock is first treated with sulfuric acid, the solution concentrated by evaporation, and then treated with nitric acid. The vanadium is precipitated as vanadyl phosphate, and the phosphoric acid is filtered off to be used in the making of fertilizer. The vanadyl phosphate is subjected first to live steam, then treated with ammonia gas and ammonium nitrate, which converts it into ammonium vanadate. The ammonium is driven off as ammonia gas by heat, leaving a residue of vanadium pentoxide, which is the form in which vanadium is supplied to the steel industry.

Vanadium is a prime toughener of steel. It is a requisite in the manufacture of armor plate, crankshafts, axle and piston rods, and other steels needed where heavy punishment will be encountered. About four pounds are added to each ton of steel, as a rule.

American steel makers have depended mainly on one mine in Peru for their vanadium supply, with certain additional amounts from Africa. However, war demands for steel have so greatly increased the quantity of vanadium needed that new sources had to be sought. There are other deposits of vanadium-containing minerals in the United States, but unfortunately they are badly scattered. However, the total supply of the vital alloy metal in this country will probably amount to several million tons, if emergency requires complete exploitation.

DEHYDRATING vegetables is not simply a matter of peeling and slicing them and tossing them into the drier. There are a lot of tricks to the trade, and ignorance or neglect of them will produce the inferior products that gave dehydration such a black eye during World War I and delayed its progress by a decade or more. Dr. W. V. Cruess, of the University of California, told of some of the things that must be done if dehydrated vegetables are to be really good.

First of all, the vegetables must be garden-fresh. Keeping them for any length of time results in a loss of vitamin C, he said. Then they must be blanched, that is, thoroughly scalded in hot steam, to stop the action of their own enzymes which will spoil both quality and color if they are allowed to continue their activities within the cells. The practical dehydrator has to know certain necessary facts about plant physiology, and apply them. Dehydration temperatures can be high at the beginning, while the vegetables still have full moisture content, because the water absorbs the heat. But near the end, the temperatures must be kept to a safe, low level.

Even after the job is finished, there are still troubles to contend with, Dr. Cruess told his listeners. Insects love dehydrated foods, and will chew through anything but metal or glass to get at them. They are highly absorbent toward atmospheric moisture, and likely to spoil in contact with oxygen; which again calls for special protective measures.

WHILE food dehydration is attracting great attention because the products can be so compactly shipped for

overseas use, quick-freezing of fish, meat, fruits and vegetables for home consumption is not being neglected. Frozen fish is in such great demand, according to Domenic DeFelice, of the New York State Agricultural Experiment Station, that hitherto unused species have had to be added to haddock, flounder and other first favorites for filleting. The frozen berry industry in the Pacific Northwest has about reached its limit, but is expanding elsewhere in the country. Boned and packaged meats are being frozen in large quantities for Army use.

THE canning industry took a body blow when Jap aggression cut off hitherto abundant tin supplies, but canners are putting up a good fight to do their share toward national food conservation, was stated by E. J. Cameron of the National Canners Association. Electrolytic tinplate, which requires far less tin than the old method, and pretreated steel plate, which requires no tin at all, are coming into increasing use. Low-tin and tinless solders also are winning their way.

DRINKS as well as foods came in for attention. Dr. A. J. Liebmann and M. Rosenblatt, of the Schenley Distillers Corporation, told of researches on the chemistry of aging whiskey which they have been carrying on for five years, with an array of about 560 barrels of liquor as experimental material. All whiskey is colorless when it is first run into the barrel, they stated. It gains color, aroma and most of the other qualities prized by the proverbial "judge of good liquor" through long contact with the wood. Three things happen: (1) Extraction of substances from the wood; (2) oxidation of some of the original substances in the liquor and also the material extracted from the wood, and (3) reaction between the original substances and those from the wood.

THE postwar automobile will burn gasoline of 150 octane rating, and it will never be necessary for the filling station attendant to put more water in the radiator because the cooling system will be permanently sealed. When you get home from your ride, you'll put the car in a garage with plastic-and-plywood walls and a stainless steel roof.

Your house will be built of the same materials, strong yet so light that two men will be able to lift the whole wall of a room as they put it up.

These are items from a vision of the future presented in an address by Dr. Charles M. A. Stine, vice-president of E. I. du Pont de Nemours and Company. They aren't just dreams, he explained; the things actually exist now, at least on an experimental basis, but are at present absorbed into the war effort.

Other new accomplishments in scientific technology were listed by Dr. Stine: glass that is unbreakable, glass that will float, wood that won't burn, shoes that contain no leather, window screens without wire, machinery bearings not made of metal. Post-victory production of consumer's goods will reach heights undreamed of in prewar days, the speaker predicted. We have built an immense industry that turns out more light metal in a year than was formerly produced in a decade, with corresponding volumes in such things as special steels, plastics, synthetic fabrics, fuels.

Having seen how abundantly we can produce for war, the American people will insist on abundance in time of peace, Dr. Stine forecast. Slums must be cleared away, he declared; the space they leave should not be filled with other buildings, but put to use as close-in airfields. Better nutrition for everyone, based on recent researches in food chemistry, is imperative for the maintenance of a population of high industrial productivity.

No doubt, some will become alarmed over the possible displacement of old materials and old industries. Changes of a drastic nature are inevitable, but they seldom result in the hardships that the timid predict. . . . Let our swords be mighty, and mighty indeed will be our plowshares.

MEATLESS days, even whole meatless months in an emergency, need have no nutritional terrors, if a supply of soybean, cottonseed or peanut flour is available, the American Chemical Society heard in a report by Theodore F. Zucker and Dr. Lois Zucker, of Columbia University. These flours, which are made from the seeds after the oil has been extracted, are very rich in protein and certain vitamins, so that they should prove highly valuable as additions to ordinary wheat flour, making bread a more nearly balanced diet. It is possible to make a meatless sandwich just by buttering two pieces of this mixed-flour bread and slapping them together. The "meat" is invisibly present, incorporated in the bread itself. Both soybean and cottonseed flours have distinctive tastes to which the eater needs to become accustomed. Cottonseed flour makes a yellower loaf than most of us are used to. On the other hand, it is very cheap—five cents a pound on the current market. Peanut flour offers less difficulty so far as taste is concerned, but its price is considerably higher.

Test batches of bread were made up out of various mixes of these seed flours with wheat flour and tried out on rats, which throve very well on them, needing no other source of proteins. They also got sufficient quantities of two necessary vitamins, thiamin and riboflavin, from the seed flours.

ANOTHER by-product of agricultural industry that may find profitable use through chemical handling is bagasse, the woody waste left after the sugary sap has been crushed out of sugarcane. Professor Donald F. Othmer and George A. Fenstrom, of the Polytechnic Institute of Brooklyn, described their experiments with this material. From a ton of dry bagasse, heated in a dry still, they obtained 35 pounds of acetic acid, one and a third gallons of crude methanol (wood alcohol) and 750 pounds of charcoal. The acetic acid and methanol are in large demand as industrial solvents, and charcoal is a familiar domestic fuel in the warm lands where sugarcane is grown. The experimenters pressed it into briquets for marketing.

WORLD WAR I caught us short on potash, necessary alike for farm fertilizer and chemical manufactures. It isn't happening this time. That the pre-1914 German monopoly

of this important mineral has been broken by the development of an American potash industry, was pointed out by Dr. George R. Mansfield of the U. S. Geological Survey. At present, only the highest grade potash deposits in the West are being worked, but these alone would be enough to supply American needs for 200 years, at present rates of use. In addition there are large quantities of other potash minerals that are not profitable to exploit at present, but may be made so by future technical advances. How potash is helping the United States to win the war was outlined at the same symposium by Dr. J. W. Turrentine, of the American Potash Institute. With plenty of this highly important fertilizer element now available, farmers need not stint their fields as they had to during the first World War, but can use all they need. This means bigger crops from the same acreage, which in turn means more bread, more meat, more vegetable oils for ourselves and our allies.

IF Nazis or Nips resort to polecat warfare and spray poison gases on the commissary stores, that doesn't necessarily mean that the troops will have to go hungry. Of course, mustard gas instead of mustard on your meat would make it unfit to eat—but if it is wrapped or packaged as well as most commodities are now-a-days it will still be good to eat after the covering has been decontaminated and removed. Do's and don't's or anti-gas protection for foods were reviewed by Dr. Sidney H. Katz, of the U. S. Chemical Warfare Service's main arsenal at Edgewood, Md. The most dangerous of so-called poison gases, from the food-contamination viewpoint, are not really gases at all but finely atomized liquid sprays. These cling to anything they touch, and unless recontaminated will remain dangerous for days. Decontamination is not a job for just any one; it must be carried on under the direction of an officer trained for this particular job. The best protection against chemical contamination, the speaker stated, is afforded by the most conventional of food packaging—tin cans and glass jars. Cellophane is very good for excluding the insidious poisons, especially when the package seams are well sealed. Tin foil and aluminum foil wrappings also are effective, but only if tightly applied. Simple paper or cloth bags are bad, but several layers of either paper or cloth give fair protection. Corrugated cardboard is good, especially if it has been given a glazed coating. Natural rubber is not as effective against war chemicals as some of the synthetic rubbers.

CHEAPER riboflavin (vitamin B_2) for bread enrichment is the prospect held forth by Dr. Jonas Kamlet, of Miles Laboratories, Inc., New York City. Ribose, a special sugar which is the only raw material from which riboflavin can be elaborated, is produced by a strain of yeast that is fed on waste sulfite liquor from paper-pulp mills, one of the most troublesome of all industrial wastes. The process was developed first at the National Bureau of Standards, Dr. Kamlet stated, and the first commercial installations are two plants set up in Canada by a Swedish engineer, G. Heijkenskjold. Similar plants will be built in the United States after the war.

DYES made directly from soft coal, instead of the time-honored coal tar, were described before the meeting by Dr. H. B. Charmbury, of the Pennsylvania State College. The coal is first treated with nitric acid, to obtain a foundation material which is then treated with organic acids and inorganic alkalis to produce the dyes themselves. These direct-from-coal dyes were tried by Dr. Charmbury on animal fibers like silk and wool, vegetable fibers like cotton and linen, and synthetics like rayon and nylon, with successful results.

PHYSICS supplemented chemistry in a search for causes of the stretchy, bouncy behavior of rubber when a group of physicists from Notre Dame University presented three papers before their chemical colleagues. The chemists remembered the classic contributions of a former colleague from the same university, the late Father Nieuwland, pioneer in the creation of synthetic rubber, as they listened to the presentations of Dr. Eugene Guth, Dr. S. L. Dart, Dr. R. L. Anthony and Dr. L. E. Peterson, together with Dr. H. M. James, of Purdue University. The picture they gave was one of a curious substance that has some of the behavior features of a solid, some of a liquid, and some even of a gas. Explanation is to be found, the speakers suggested, in the shape of the individual rubber molecules, which are long, spiral, wormlike affairs that hook their coils together like tangled springs. One of the gas-like properties of rubber is its curious sudden rise in temperature when it is stretched, and its cooling when it contracts. This can be tested by any one, merely by touching the lips to a quickly stretched rubber band. The Notre Dame scientists have made a quantitative study of this strange temperature effect in rubber, with sensitive scientific instruments. Their data are expected to be of value in the future development of both natural and synthetic rubbers.

COAL is commonly thought of primarily as food for the mouths of factory furnaces, rather than as a material of great benefit to farmers—beyond keeping their houses warm, perhaps. But that farmers are beneficiaries of the mining and coal-processing industries in a number of ways, was pointed out by Dr. Hubert G. Guy, of the Koppers Company, Pittsburgh. Ammonia compounds, by-products of the coke industry, have become one of the principal sources of fertilizer nitrogen. Naphthalene, a by-product of coal carbonization, is widely used to combat several kinds of insect pests, as well as in preserving stored hides. Synthetic plant hormones, also originating from coal, hasten the formation of roots on cuttings and are sprayed on orchard trees to prevent premature dropping fruit. Other coal products are used as food colorings, wood preservatives, disinfectants and parasite killers.

ANTHRACITE coal is coming into wide-spread use for filtering city water supplies, replacing the long-used sand beds, according to Dr. Homer G. Turner, of the Anthracite Equipment Corporation, New York. During the past seven years anthracite for filter use has been shipped to every state in the Union and to Alaska, Canada, South America, England, Australia and Iran.

SCIENCE

VOL. 90 FRIDAY, SEPTEMBER 18, 1942 No. 24[illegible]

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE FIRST NATURAL HISTORY MUSEUM IN AMERICA

By Dr. GEORGE GAYLORD SIMPSON

AMERICAN MUSEUM OF NATURAL HISTORY

ADMIRATION for superlatives is a human (some say more particularly an American) trait. For the thousands of employees of American natural history museums and for their millions of visitors the identification of the first and the oldest institution of this sort has inevitable fascination. This honor is frequently and authoritatively claimed for the Charleston Museum.[1] As far as I know, the claim is not currently made for any other museum. Nevertheless, renewed study of the available historical data shows that some facts have been overlooked and that the previous honest and able interpretation of others becomes equivocal when provided with more complete background. It is, in fact, most unlikely that the Charleston Museum can properly be designated either the first or the oldest in America, and the statement requires careful reconsideration before it becomes ineradicably imbedded in the accepted histories of science.

[1] The claim is included in most of the publications of the Charleston Museum and was particularly publicized by a meeting of the American Association of Museums in Charleston in 1923 on the occasion of celebrating the "150th anniversary" of the "first museum founded in America." The following are among the many historical papers and books in which the Charleston Museum is unqualifiedly accepted as first and oldest in America: P. M. Rea, *Proc. Amer. Assoc. Mus.*, IX, pp. 53–65, 1915; L. M. Bragg, *Charleston Mus. Quart.*, I, pp. 3–13, 1923; C. Schuchert, *Bull. Peabody Mus. Nat. Hist.*, I, No. 1, pp. 9–23, 1926; W. M. Smallwood and M. S. C. Smallwood, "Natural History and the American Mind." 1 vol., 8vo. New York. 1941.

The facts are a matter of record and their interpretation is a matter of impartial scientific method. This reconsideration is in no sense an attack on the admirable Charleston Museum, the present excellence and past achievements of which are not depreciated by denial of its historical priority. Museums are temples of truth, and the Charleston Museum welcomes any contribution to the truth concerning itself.[2]

The growth of natural history museums was gradual, and in such a sequence the designation of an absolute first is virtually impossible. Did American natural history museums begin when a colonist first put a curiosity in his parlor? When a society first installed samples of natural productions in its rooms? When a collection was first opened to the general public? When the first organization specifically for the maintenance of such a public exhibition was formed? Most of these transitions were gradual, and in no case is there any assurance that an earlier incident has not been overlooked. It is, however, possible to establish some dates and to set up a sequence among certain known museums and museum-like institutions.

The American Indians had "private collections" of objects that we would place in museums. They carry this phase of the history back to 900 A.D. at latest. The white colonists also had personal natural history collections at least as early as the seventeenth century. Such private enterprises were the forerunners of museums, but it will hardly be claimed that they were museums in any strict sense.

The beginning of museums is more definitely seen in the acquisition and exhibition of specimens by various societies. The earliest collection of this sort known to me—caution forbids claiming it as the first in fact—belonged to the American Philosophical Society, Philadelphia. The date on which this collection was begun is unknown, but it was prior to April 20, 1770, because on that day a proposal was made to enlarge the collection, which therefore existed.[3] This collection was available to members and to others on application, and it was also open to the public at large while under the aegis of the elder Peale in 1794 to 1811. It was continuously cared for by curators, so designated, and was greatly enlarged up to 1849, when it was deposited in the Academy of Natural Sciences of Philadelphia. There this collection, begun in 1770 or earlier, still exists and is still the nucleus of a natural history museum. The Academy of Natural Sciences, itself, was founded in 1812 and it may now be the oldest natural history museum in America in terms of continuous existence under the same name and the same organization, although other claimants may well appear. Among other old museums still in existence as entities but changed in organization are the East India Marine Hall of Salem, 1799, now the Peabody Academy, and the mineral cabinets of Harvard, 1793, Yale, 1803, and Princeton, 1817, now included in subsequently founded university museums.[4]

The Philadelphia Museum, founded by Charles Willson Peale in 1785, was one of the first, probably the first, of American public natural history museums to be definitely founded and organized as such.[5] The Peale collection was privately owned, but the status of the museum as a fully public institution is amply attested, among other things, by its direction by a board of "visitors" (we would say trustees or directors) of which Thomas Jefferson was first president, by its display in the Philosophical Society's Hall along with the society's own collection and by its later occupancy of the public building now called Independence Hall. An admission fee was charged (as in many later public museums) but there was no other requirement for admission. As far as I have learned, previous American collections or museums were open to members of some organization or by permission of the owners and hence can not be called fully public.

This museum no longer exists as such, having been dispersed after about sixty years, and therefore does not bear on the question of which is the oldest among our existing museums. Whether it was the first is a matter of definition. It probably was the first that could properly be called a public museum, if "public" is defined by full availability to the population at large. If "public" is additionally defined as involving institutional or communal rather than personal ownership, some claim could still be made for the Philadelphia Museum as regards the period (1794 to 1811) when it displayed not only Peale's collection but also that of the Philosophical Society. Under this or a still more stringent definition, however, this honor might have to go to some later institution.

January 12, 1773, sometimes accepted as the date of the founding of the Charleston Museum, was the day on which the Library Society of Charles-Town voted to establish a museum. This proposal was made nearly three years after the Philosophical Society's cabinet is known to have been in existence. The effective acquisition of a natural history collection by the Library Society appears to have been still later. The Library Society's proposal was for a "museum" and

[2] This statement is authorized by G. Robert Lunz, Jr., curator of the Charleston Museum, who kindly read and commented on the present note before it was sent to press.

[3] American Philosophical Society. 1884. Early proceedings from the manuscript minutes of its meetings from 1744 to 1838. *Proc. Amer. Phil. Soc.*, XXII, Pt. III, No. 119. [See entry for April 20, 1770; the contemporaneous minutes are in the Society Archives.]

[4] These universities had some natural history specimens at still earlier dates, Yale at least as early as 1786 and Harvard by 1784.

[5] H. S. Colton, *Pop. Sci. Monthly*, LXXV, pp. 221–238, 1909. Publications by the Peales and data in the archives of the American Philosophical Society have also been consulted.

the Philosophical Society had a "cabinet," but to base any claim for priority on this verbal distinction-without-a-difference would completely lack historical or scientific justification. For the men of that time "museum" and "cabinet" were synonyms as used in this connection and the collections in Charleston and in Philadelphia had the same *status*: both were devoted to the public good but both were society collections. Reverting to definitions, if a society collection arranged and displayed for members and authorized visitors is a museum, both of these were museums and that in Philadelphia was certainly older. If an exhibition must be more public to be called a museum, then neither of these was a museum despite the fact that the collection in Charleston was called such in a sense different from this.

An exhibition in Charleston, no longer sponsored by the Library Society but by the Literary and Philosophical Society of South Carolina, was opened to the public, on payment of a fee, in 1824, in conscious imitation of Peale's Philadelphia Museum, then 39 years old.

The descent of the present Charleston Museum from the museum of the Library Society of Charles-Town is based on the transfer of specimens from one institution to another, without continuity of organization, personnel, name or establishment. The Literary and Philosophical Society of South Carolina started a museum in 1814, and the collections of the Library Society were presented to this in 1815. It was this second of the museums in Charleston that was opened to the public in 1824 under the name, The Museum of South Carolina. The attempt to raise money for a building was unsuccessful, and in 1827 the collections were deposited in the Medical College of the State of South Carolina. In 1850 still another museum was established, this time by the College of Charleston. Along with various other collections, this museum acquired by gift the Literary and Philosophical Society Collection, which still included some specimens that had belonged to the older Library Society. In 1907 the museum of the College of Charleston acquired its own building and in 1915 it was incorporated as the Charleston Museum. (Dates and data from Rea, corroborated by others. See first footnote.)

Thus the present Charleston Museum has existed as an entity since 1850 and has had its present name and organization since 1915. It possesses specimens that were added (in 1798 and later) to a collection begun, or proposed, in 1773. If this possession be considered as involving some sort of continuity for the institution, then priority by similar but more direct continuity must be granted to the Philadelphia Academy (which is a museum and not an academy in the more common sense) as depository for a collection begun in 1770 or earlier.

Many other early American collections and museums are worthy of remembrance and discussion. Some were first in one respect and some in another. Which, if any, can be truly called *the* first or *the* oldest is left to the discretion of the reader and of historians.

COOPERATION WITH THE FILM INDUSTRIES IN THE STUDY OF PRIMITIVE MUSIC

Professor CARL E. SEASHORE
THE STATE UNIVERSITY OF IOWA

Acoustical engineering, playing into the hands of the theater, has made great progress within the last few years revolutionizing the means of communication, enriching the resources of the art of public entertainment and changing the economies, interests and tastes of the public. The acoustical engineer has dealt primarily with the physical instrument and its environment; the theater has dealt primarily with the problem of merchandizing amusement. But each has an equally large field of approach quite untouched. The acoustical engineer must reach out into the psychological and phonetical analysis of human hearing and feeling as they function in music and speech, and the theater must take cognizance of the educational value and the factual basis of its informational films.

The informational value of amusement through tone films has increased the educational power of the theater to an extraordinary degree. But in so doing the producers have failed to recognize the sanctions and canons which are demanded by a scientific approach to music, speech and pictures. They have engaged entertainment experts to select and organize for pictures in the field. In so far as the interests of music are concerned, the time has now come to consider the factual side of the picture at the source by having scientific experts associated with the entertainment experts. Let me outline briefly a proposal which I made to the motion picture academy in Hollywood at the time the film Trader Horn appeared, asking for recognition of faithfulness in fact and educational utility of informational films.

To illustrate my point of view in a concrete case,

let us consider the planning of a specific project for penetration into a primitive community. Let us say that one of the standard producers is undertaking to make a film to represent the primitive culture of a relatively pure strain of savage people in one of the South Sea islands.[1] In the interest of securing correct and effective representation of the resources, characteristics and uses of music and allied dance and speech in this primitive group, the producers should send a competent musical anthropologist to the locality a year or two in advance of the actual photographing. Among the qualifications and functions of such an expert for the study of primitive music would be the following:

(1) He must go well prepared in the psychology of music, the history and theory of music and the anthropological and ethnological literature bearing on primitive music and allied arts, such as the dance, drama, speech and magic, in order that he may have in command a well-organized matrix of facts and theories into which he is to set new facts and classify his observations.

(2) He will cultivate the acquaintance and good-will of the primitives in such a way as to be admitted to the dwellings, the ceremonials and all outstanding types of activity in which there may be some semblance of a function in music. In so doing, he should be able to select unobtrusively the outstanding performers for the demonstration of scientific aspects of this project and at the same time prepare for the cameraman by identifying interested groups which might function willingly and faithfully upon his appearance. Primitive communities are conservative, but they are interested in all forms of magic. It should be the function of the scientist to utilize this interest in cultivating responses which shall reveal the true life of the people. For this purpose such devices as the phonograph, the camera and moving pictures may be employed to create a receptive atmosphere for the incoming film organizers. While the scientist is initiated into the life of the tribe or community by his two years of residence, he will lead a sort of heroic life by introducing into their play life a pattern which is in harmony with their culture level and will lead to self-forgetfulness and revealing self-expression in all performances.

(3) Through such patronage of the industry for an adequate period of intensive study of the musical life of the community, the scientist should be able to discover and isolate characteristic features of a purely scientific interest and rehearse these in significant forms through his play life with the people so that at the time of the arrival of the photographers he will have a purely scientific program set up in the form of a series of short specific acts which may later be taken purely for a scientific purpose and will constitute a well-designed scientific collection which is made during his residence. Producers have assured me that they would be delighted to take these pictures without cost to the scientific interests in recognition of the service rendered and donate them to appropriate collections unretouched and freely available for scientific study by home experts. In his critical and constructive study, the scientist should exercise insight into the various types of affiliates with music; such as dance, speech and mimicry, and try to reveal the ethical and esthetical significance of the entire setting at the culture level of this particular group. The sound films will, of course, be accompanied by moving pictures revealing the actual behavior and environment in which the performance took place.

(4) In the meantime because of his personal fitness and training, the collector will have paved the way for the organization of amusement features which will give effective cues and provide trained actors for the exhibition films. This in itself would be an adequate service for which the producers would be glad to cover the expenses of the scientist. Naturally he would serve as a consultant in the organization of the amusement features in such a way as to give them a sound educational tone and validity. This well done would give scientific and educational value to the pictures in the theater. It should in no way interfere with the entertainment value of the picture because patrons of the movies would be quick to discover that in such cases truth may be stranger than fiction.

(5) It is conceivable that the purely scientific pictures authorized by the sponsoring scientists might even find a place as shorts in the standard theater films. The adoption of that policy might prove an innovation now that education in popular science is so general in this country.

(6) The right to advertise the backing of scientists in moving pictures has justly been the bugbear and drawback in enterprises of this kind. But this is due to the failure to develop and follow a reasonable policy of cooperation. Both parties can now take a long stride forward in solving this problem. The two interests are now so closely dovetailed that some satisfactory way of cooperating must be found. To be effective, any such plan must operate in the selection and sponsoring of the scientist and must be defined specifically in his contract. Scientists and educators should realize that it is an obligation and is as much to their profit as it is to the profit of the industry.

[1] The same principle would apply to the filming of racial characteristics of music or racial life in general, not necessarily primitive, such as the music of the American Negro or Indian or any clean-cut national type of folk music.

(7) The first steps in the scientific work on such a collection in the field of primitive music would naturally be (a) to take the films into the laboratory and rephotograph them in suitable form for construction of performance scores[2] for which we now have adequate techniques and patterns; (b) these performance scores should then be published in order that they may be permanently preserved as a graphic representation of all the findings; and (c) the collector should publish with the performance score his technical field notes.

(8) To implement the scientific use of the collection, it is essential that the various musicological, psychological and anthropological organizations for research should cooperate with their representative, not only in the recognition of him as the authentic collector, but in the organizing of research staffs for the purpose of utilizing the collection in the various scientific interests. It is therefore desirable that the prospective collector should, before he goes, acquaint himself with the ways and means of promoting research in this field through the various professional research agencies. A one-man collection of that type could serve as sufficient research material for a large staff of workers.

In conclusion I may say that when I first broached this proposition to the Academy of Motion Picture Arts and Sciences in Hollywood, great interest was shown, and from several sources I heard the question, "Where is your man?" I gained the impression that if the right man had been available at that time, the project would have been undertaken immediately.

[2] See Univ. Ia. Stud. Psychol. Mus., IV, 1937.

SCIENTIFIC EVENTS

RECENT DEATHS

Ernest Calvin Bryant, professor emeritus of physics of Middlebury College, died on September 7 at the age of seventy-five years.

Dr. Henry Rawle Geyelin, assistant clinical professor of medicine at Columbia University, died on September 7 at the age of fifty-eight years.

Martin Luther Griffin, retired chemical engineer, died on August 28 at the age of eighty-three years.

Arthur C. Tozzer, civil engineer, vice-president and a director of the Turner Construction Company, New York City, with which he had been associated since 1905, died on September 9 at the age of sixty-three years.

The death is announced of Dr. John Henry Salter, known for his work in ornithology, entomology and systematic botany, from 1891 to 1908 professor of botany at University College, Aberystwyth, Wales.

THE ACHIEVEMENTS OF MEDICINE IN SIBERIA

According to information sent to Science by the Soviet Embassy, a scientific conference recently took place in one of the medical institutes of Novosibirsk. This conference was devoted to the anniversary of the activity of medical institutions in Siberia during the war. Over three hundred surgeons and scientific workers participated. The work that is being carried on by the Siberians during the war was illustrated by eighty-five reports and communications which aroused great interest. The report continues:

Professor Schneider described his new methods of skin plastics. Professor Kohn and Shereshevsky spoke of the origin of dimness of the vitreous body in the eye and ear and of the new methods of treatment. Professor Menshikov made a report of his experience in treating complications caused by wounds of the thorax.

The experience of local hospitals has made it possible to start anew the elaboration of the following problems of war surgery, namely, the treatment of gunshot fractures, accumulation matter in the pleural cavity, adaptation of roentgen-therapy and of new apparatus for mechano-therapy. Dr. Pogorelsky related his experience in treating irregular concrescence of thigh fractures through bloodless transference into normal position. Members of the conference were highly interested in the apparatus demonstrated by Dr. Freifeld, who had constructed out of wood a universal set for mechano-therapy and medical splint for active movements of fingers and hand. Professor Pavoletzky and Dr. Khalinsky had applied with great success roentgen-therapy for treating war traumas. The communication by Dr. Tugetzky on the development and innervation of blood vessels in a man caused great interest and wide-spread approval.

In the first half of July the session was organized in Novosibirsk by the All-Union Institute of Experimental Medicine. This was quite an event in the medical world of the Siberian capital. Several hundreds of scientific workers and surgeons were present at this session. Professor Grastchenkov gave a report on "character of modern wounds of the skull and brain and their graded treatment"; Professor Menshikov on the significance of vitamins in complex therapy of war traumas; Dr. Levkovich on the etiology and prophylaxis of spotted fever; Professor Davrentiev on the morphology regeneration of the nerve-trunk. It is known that when a part of the nerves is traumatized or annihilated by a bullet or shell fragment, the part of the body supplied by nerve branches loses its sensibility and its motor capacity. New plastic methods of nerve conduction revive the ability to work of thousands of soldiers suffering injuries of the peripheral nerves.

AERONAUTICS AT THE UNIVERSITY OF ILLINOIS

The University of Illinois announces that funds will be sought to create an airport adequate for instructional and research purposes.

The university has completed a free summer course for high-school instructors in aeronautics. The seventy men who took this course now are back at their schools giving secondary school pupils basic information about air power and its importance in war and peace.

Research at Illinois into air transportation problems will include study not only of the machines and the airports necessary for their use, but also of the men who operate and use them. Already allocated is a sum of $190,200 for initial building changes, equipment and installations to further a research and educational program on the influence of atmospheric environment, including the problems of aviation, submarine and military medicine.

The program of the College of Medicine in Chicago, in cooperation with the College of Engineering at Urbana, follows research projects under way since 1937 by the Colleges of Medicine, Agriculture and Engineering which concerned the influence of atmospheric environment on humans and animals.

To provide for actual "in-the-air" educational and research activities, President Arthur Cutts Willard has announced that his next budget request to the State Legislature will include an item of $200,000 for the purchase of a square mile of land at Urbana-Champaign for a university Class 3 airport capable of handling planes up to 50,000 pounds gross weight. Among the uses of the airport will be the Civilian Pilot Training program in which the university has taken part for several years, and probably the establishment after the war of an aviation unit in the university R.O.T.C.

In expanding its activities to education and research for air transportation, Illinois is continuing the service policy under which it was established and under which it has made important contributions to the two leading forms of land transportation—railways and highways.

As the state university of the nation's railway center and leading railway state, it established the first department of railway engineering, and its researches into roadbeds, rails, brakes, wheels, fuel and other railway subjects has contributed much to safe and fast trains.

Likewise, the university was a pioneer in the study and development of reinforced concrete. Its research contributions on the relative merits of butt welds and rivet stresses have proved important in ship building. Highway research has included not only the roadway and its problems, such as materials and joints, but also intensive study of bridges of all kinds both of steel and of concrete.

MICROFILM PHOTOGRAPHY

Air conditioning is serving a useful role in helping to preserve and protect priceless documents against the hazard of bombing raids. Experience with microfilm photography in the Photographic Laboratory at Brown University shows that air conditioning is essential to this process, now in increasing use, as a means to guarantee against the loss of valuable records and documents.

"Microfilm requires precise control in processing if the results are to be reliable and permanent," according to Edward C. Roosen-Runge, in charge of the Brown laboratory. He states:

> In our laboratory the dark room, enlarging room and camera room are all air conditioned and kept summers and winters at 68° F. and 50 per cent. humidity.
>
> The air conditioning serves three purposes: First, the air is kept dust free, which is of the greatest importance because of the smallness of the printed matter on the film. One dust particle on the film or one scratch caused by dust may obscure a whole word completely.
>
> Second, the temperature control is a very essential help in obtaining even results in processing, quite apart from the convenience and comfort of the operators.
>
> Third, the humidity control serves to keep a perfect storage condition for the film. In addition, it again helps toward a precise control of the processing and drying.

The Brown University Photographic Laboratory, employing Carrier refrigeration and air-conditioning equipment, is working on several microfilm projects. One of these involves microfilming for the expansion of the Brown Mathematics Library, already well-known throughout the country. About 1,000,000 pages have so far been photographed in this project. Another is concerned with the microfilm service for *Mathematical Reviews*, an abstract journal. In connection with the publication of this journal, the mathematical articles to be abstracted are photographed on microfilm. The subscribers to the journal may order at special rates copies of the complete articles either as photoprints or as microfilm. The photographic laboratory has made so-called master negatives of about 6,500 articles on film which are stored in the laboratory in a special file.

A project to film books on South American history and Hispanic culture at South American libraries forms another use for microfilm. The films are processed in South America and sent to the laboratory where copies are made. One complete copy is destined for the Library of Congress. More than 100 reels containing about 1,150 items have been photographed so far.

THE COMMITTEE ON CONSERVATION EDUCATION

THREE years ago Mr. Darling, as president of the National Wildlife Federation, and its executive board asked Dr. Henry B. Ward to assume the position of chairman of a new committee. Conservation education had been proclaimed as the primary objective of the federation and he undertook to devote his time to the promotion of this objective.

The work is carried by a small committee of official members and an informal advisory board of approximately 1,000 teachers and leaders in educational circles. These informal advisers are distributed over the length and breadth of the United States. They were willing to aid the promotion of a genuine educational movement, but did not desire to have their names and addresses published, since that would inevitably lead to added correspondence, discussion and perhaps extended argument which they felt could not be handled without waste of time and energy as well as probably also unfortunate interference with their professional duties and obligations in other directions. The work has been carried on actively, but with relatively little publicity.

The first public undertaking was a conference on education in conservation held at the annual meeting of the National Wildlife Federation in Detroit on February 16, 1939. The record of this conference is given in the first pamphlet issued by the committee. It contained the keynote address of the campaign, by Thomas Eliot Benner, dean of the college of education, University of Illinois. This, which outlined a general plan of action and sequence of steps that should be taken to achieve satisfactory results, was followed in the pamphlet by half a dozen brief comments on special movements in conservation education at different points.

A year later at the Washington meeting of the federation a round table discussion was held which with a report of progress by the chairman was printed as the second pamphlet, which opens with a report on the year's work directed towards reaching conclusions on the problems set forth in Dean Benner's address. In the pamphlet this report was followed by brief comments and criticisms.

The third publication took the form of a symposium on "The Foundations of Conservation Education." It assumed the proportions of a book and constitutes the first educational contribution on this topic which has appeared.

A fourth publication entitled "Teaching Conservation in the Public Schools" has been prepared. Its printing and distribution will be carried out as soon as conditions permit.

Colored stamps, portraying types of life, both plants and animals, are issued in sheets every year in connection with the celebration of National Wildlife Week, designated by the President. Leaflets and pamphlets dealing with individual problems or projects of interest to the lover of nature and with fishing and hunting are issued irregularly and distributed on request. Unique grade school booklets have been prepared by a group of successful teachers and printed in attractive form for use in grades three to eight of the public school system.

Full information on work of the federation may be secured from the business office of the National Wildlife Federation, 1212 Sixteenth Street, N.W., Washington, D. C.

THE RESEARCH ADVISORY COMMITTEE OF THE NATIONAL ASSOCIATION OF MANUFACTURERS

DR. A. R. OLPIN, director of the Research Foundation of the Ohio State University, has been appointed chairman of the Research Advisory Committee of the National Association of Manufacturers, which met for the first time under its new chairman in New York City on September 10. Dr. Olpin succeeds Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, who has resigned because of the pressure of other war work in which he is now engaged. Matters on the agenda for the New York meeting included proposals for the exchange of information by universities and research institutes and coordination of research activities in connection with the war effort.

Dr. Olpin has been director of the Research Foundation since 1938. In that work he now has the responsibility of administering research contracts amounting to well over a million dollars annually. In addition he serves as consultant to several war committees in Washington.

Other members of the National Association of Manufacturers Research Advisory Committee include Dr. Henry A. Barton, the American Institute of Physics, New York; C. W. Good, the Department of Engineering Research, University of Michigan; Dr. Ross G. Harrison, National Research Council; G. Stanley Meikle, Purdue Research Foundation, Lafayette, Ind.; Dr. R. A. Millikan, California Institute of Technology; Dr. F. R. Moulton, the American Association for the Advancement of Science; Dr. George R. Pegram, Columbia University; Nat Sage, Massachusetts Institute of Technology; Raymond Stevens, Arthur D. Little, Inc.; Dr. E. R. Weidlein, Mellon Institute of Industrial Research; Dr. John T. Tate, University of Minnesota; Julius Weinberger, Radio Corporation of America, New York City.

SCIENTIFIC NOTES AND NEWS

DR. CHAUNCEY D. LEAKE, librarian and since 1928 professor of pharmacology at the Medical Center at San Francisco of the University of California, has been appointed vice-president of the University of Texas in charge of its medical program. Dr. Leake will be stationed for the present at the University of Texas Medical School at Galveston. The incorporation with the university of the Texas Dental College under Dean F. C. Elliott has also been announced. Plans have been made for a graduate medical center at Houston to include cancer work sponsored by the M. D. Anderson Foundation, to be under the direction of Dr. E. W. Berger.

DR. HENRY A. CHRISTIAN, Hersey professor of the theory and practice of physic, emeritus, has been invited by the president and fellows of Harvard University to return to active duty to give clinical instruction. Also, he has been appointed visiting physician at the Beth Israel Hospital, Boston.

DR. NEIL E. GORDON, of Central College, Fayette, Mo., has been appointed head of the department of chemistry at Wayne University to fill the vacancy caused by the retirement of Frederick C. Irwin a year ago.

THE Moxon Medal of the Royal College of Physicians of London has been awarded to Professor L. G. Parsons for his observation and research in clinical medicine, especially in pediatrics; the Weber Parkes Prize to Professor G. S. Wilson for his work on tuberculosis, and the Murchison scholarship to Dr. Hector John Anderson (St. Thomas's).

THE honorary medal of the Royal College of Surgeons of London has been awarded to Lord Nuffield in recognition of his service in "assisting the improvement of natural knowledge and of the healing art and of his many liberal acts and distinguished labors inspired by the desire to advance the science and practice of medicine and surgery." The medal was instituted one hundred and forty years ago and this is the nineteenth occasion on which it has been awarded. The Gilbert Blane Medal was presented recently to Surgeon Commander Edward Rex Pascoe Williams for his original work on blast effects in warfare. This medal was founded in 1830 by Sir Gilbert Blane, a distinguished physician, known for sanitary reforms in the Navy and for successful measures for the prevention of scurvy. It is awarded annually to a medical officer in the Royal Navy for "skill, diligence, humanity and learning in the exercise of professional duties."

PROFESSOR KENNETH W. SPENCE, associate professor of psychology at Yale University, has become head of the department.

PROFESSOR ARIEL A. BENEDICT, of the department of physics of Iowa State College, has resigned to become head of the department of physics at Muskingum College.

PROFESSOR HOWARD M. FRY has been appointed head of the department of physics at Franklin and Marshall College.

IN the College of Applied Science of Syracuse University, Howard W. Eves, of the mathematics staff of the Tennessee Valley Authority at Chattanooga, Tenn., has been appointed assistant professor of applied mathematics, and Kenneth C. Tippy, of Chicago, has been appointed assistant professor of civil engineering.

DR. ARTHUR R. CARR, dean of the College of Engineering of Wayne University, has been appointed institutional representative of the Engineering Science Management War Training Program sponsored and financed by the government. This program includes sixty-three different tuition-free defense courses to be offered for the new semester by the departments of engineering, business administration and physics.

AT Cooper Union, New York City, Dr. Alfred Reis, who formerly engaged in research at the Sorbonne, has been made adjunct professor of metallurgy, and Professor John A. Ely, of the University of Hawaii, a former dean of engineering at St. John's University, Shanghai, has been appointed adjunct professor of civil engineering. Walter S. Watson, director of admissions and student relations, has been promoted to an associate professorship of psychology.

THE resignation is announced of Dr. Charles Hendee Smith, professor of pediatrics at the New York University College of Medicine.

DR. LAWRENCE T. ROYSTER, head of the department of pediatrics of the department of medicine of the University of Virginia, Charlottesville, has resigned.

THE retirement is announced of Professor W. Peddie from the Harris chair of physics at University College, Dundee, in the University of St. Andrews.

DR. CHARLES BYRON JOLLIFFE, assistant to the president of the Radio Corporation of America and chief engineer of the laboratories, has been appointed vice-president and chief engineer of RCA Manufacturing Company, Camden, N. J.

DR. HAROLD G. WOLFF has been appointed neurologist in charge of the new pavilion of the New York

Hospital for the study and treatment of neurological cases. Neurosurgery has been placed under the direction of Dr. Bronson S. Ray.

Dr. Tom D. Spies, on leave of absence as associate professor of medicine of the College of Medicine of the University of Cincinnati, is reported to have accepted an invitation to continue his experiments at the Hillman Hospital, Birmingham, for another year. A large part of his work in vitamins was carried out at the hospital. Plans are being considered to enlarge his laboratory facilities.

The Near East Foundation announces that Professor O. S. Morgan, professor of agriculture at Columbia University, has left by plane for Beirut to expand the agricultural program of the foundation in Lebanon and Syria. He will make his headquarters at the American University of Beirut.

Dr. Frank E. Egler, assistant professor at the New York State College of Forestry, Syracuse, has returned from Central America, where he has been engaged since February in studies on the sapodilla tree, source of chicle, and on rubber and antimalarial drugs.

Dr. Carl R. Fellers, research professor of horticultural manufactures at the Massachusetts Agricultural Station, has been called to active duty with the Chemical Warfare Corps of the Army.

The following members of the faculty of Iowa State College have been called to service with the forces of the United States: Professor Jean C. Hempstead, department of general engineering, first lieutenant in the Engineers Corps at Maxwell Field, Ala.; Professor Charles G. Rowe, department of modern languages, lieutenant and language specialist in the Navy Language School, Cornell University; Professor Archie Higdon, department of theoretical and applied mechanics, major with the Army Air Forces at Jefferson Barracks, Mo.

It is reported in *Nature* that a panel has been set up in England to inquire into the possibility of improving the ventilation of tanks either by use of refrigeration or by air conditioning. It is constituted as follows: S. A. Wood, senior scientific officer, Scientific Research Department, Ministry of Supply; Dr. Dorey, chief engineer surveyor, Lloyd's Register; and Dr. Ezra Griffiths, principal scientific officer, Department of Physics of the National Physical Laboratory.

Drs. Stuart Mudd, of the University of Pennsylvania, and Michael Heidelberger, of Columbia University, will participate on the evening of September 23 in a discussion on "Vaccines Against Enteric Infections as a War Problem" at the College of Physicians and Surgeons, New York. The discussion is the first of a series being arranged by the New York Bacteriologists' War Research Projects Group to review bacteriological problems of current war importance in order to formulate research projects to be undertaken by members of the group. The group is an autonomous body originally formed through the efforts of the New York Branch of the American Association of Scientific Workers, which is planning to help to organize similar groups in other fields of science.

Archives of Biochemistry, a new journal in biochemistry, has been announced by the publishers, The Academic Press, Inc., 125 East 23rd Street, New York City. The first issue will appear about the middle of October. The purpose of the new journal is to provide a medium of publication for scientific papers in the widening scope of biochemistry. The fields to be represented are: Proteins, hormones, vitamins, viruses, enzymology, biochemical and biophysical research in chromosomes, metabolism, nutrition, photosynthesis, plant chemistry, organic chemistry as far as related to living organisms, colloid science in its biological applications and chemotherapy. The editorial board is composed of Professors M. L. Crossley, American Cyanamid Company, Bound Brook, N. J.; R. A. Gortner, University of Minnesota; F. C. Koch, Research Department of Armour and Company, Chicago; C. M. McCay, Cornell University; F. F. Nord, Fordham University; F. W. Went, California Institute of Technology, and C. H. Werkman, Iowa State College. Manuscripts may be sent to any of the editors or to the editorial office at 125 East 23rd Street, New York City. Two volumes per year are planned, the cost of each volume being $5.50.

Dean Francis G. Blake, of the Yale School of Medicine, states that a large group of medical texts has been given by Dr. Joseph Marshall Flint to the historical library of the School of Medicine. At the same time, he announced the establishment of the John E. Lane Collection of prints, to be built up around a nucleus of 136 medical engravings given to the library by Dr. George Blumer, David P. Smith clinical professor of medicine, emeritus. Dr. Blumer is giving his collection of framed engravings of medical figures to the historical library. The John E. Lane Collection will include, in addition to Dr. Blumer's gift, the entire collection of prints belonging to the medical school, many of which came to the library through a bequest of Dr. Harvey Cushing, as well as all other prints which may be added in the future. The collection is named in memory of the late Dr. John E. Lane, who served as a clinical professor of dermatology from 1920 to 1923 and from 1930 to 1933.

During the summer term (1942) at Clark University a special war service training course in the field of geography has been conducted. In addition to the

regular members of the staff the work has been supplemented by the following visiting lecturers: Dr. Charles F. Brooks, of Harvard, in meteorology; Arthur Robinson, of the Cartographic Division, Office of Coordinator of Information; Richard Edes Harrison, cartographer for *Life* and *Fortune;* George B. Cressey, Syracuse University; Earl B. Shaw, Worcester State Teachers College. The work has been under the immediate direction of Wallace W. Atwood, Jr., associate professor of geography, who has taken charge of cartography, photogrammetry, field work and map interpretation. President Wallace W. Atwood, Dr. Samuel Van Valkenburg, Dr. Clarence F. Jones and Guy H. Burnham have also contributed to the program. Special attention has been given to economic geography, the geography of the war zones and to training in geographic research. Several of those who have taken this work will soon go into active service. On September 21, a new group will be admitted for similar training for war service in geography. The demand for experts in this field is far beyond the present supply.

DISCUSSION

MODERN VOCATIONAL AGRICULTURE

"FORTY Years of Helping the Farmer with Knowledge," published in SCIENCE for June 5, is a frank and challenging article with much of which I can agree. However, it is distinctly misleading at certain points, particularly as it deals with agriculture in our secondary schools.

Modern vocational agriculture does not aim at holding all farm boys on the land. It assists in providing sound guidance regarding opportunities in farming and other agricultural occupations and then helps to train those who apparently will fare best if they follow these occupations.

Teachers of agriculture in the secondary schools do not confine their efforts to the teaching of boys. In 1940–41, the latest year for which I have data available, teachers of vocational agriculture in the United States taught 253,691 adults (exclusive of those enrolled in defense education classes) and 332,612 persons of high-school age. Enrolments in classes for adults are growing at a much more rapid rate than enrolments in high-school classes. Thus teachers of agriculture are already extensively engaged in working with people who are established in farming.

We recognize in vocational agriculture, as Dr. Chandler does, that experience in farming is the basic preparation for farming. We have found, however, that school instruction closely correlated with farming experience and some school supervision of farming experience make that experience much more valuable than farming alone can be. This combination of science with practice has proved most acceptable to the farming people of America, as shown by the rapid growth in the number of schools providing it and in the enrolments in the classes in agriculture in these schools. Approximately 9,000 high schools in the United States now offer vocational agriculture.

Teachers of agriculture are, in general, eager to keep in touch with the colleges of agriculture and their extension services. Often it has been made very difficult for them to do so. These teachers want graduate courses in agriculture as well as in education, but they are not always able to get appropriate courses. They want other types of assistance, but some colleges of agriculture have chosen to give nearly all their help to the county agents, ignoring the teacher group.

Here at the University of Illinois three eighths of the graduates of the College of Agriculture go into the teaching of vocational agriculture. This group is regarded by the college as a very important group, both before and after graduation. Through this group, the college has one of its most important outlets to the state. Two men are employed full time in liaison work between the college of agriculture and the teachers of vocational agriculture to determine the subject matter needs of these teachers and to secure from the college the services they desire. County agents and teachers of vocational agriculture have grown up together, have been educated together and work together in their counties in the spirit of a large but closely knit family. This is to a considerable extent the situation in most states.

It is unfortunate that California, in which the relations between vocational agriculture and the college of agriculture are probably the poorest in any state, should be held up as an example. Vocational agriculture in California has from the beginning been so nearly ignored by the College of Agriculture of the University of California that it has been considered necessary to set up a completely separated program for vocational agriculture whose isolation from the college of agriculture Dr. Chandler deplores. In spite of the indifference of the College of Agriculture, vocational agriculture has thrived in California. Several other colleges of agriculture started out in the direction in which California's College of Agriculture has gone but have retraced their steps, so that California is now unique in its relationships between the agricultural college and vocational agriculture.

Dr. Chandler seems not to be concerned with the effects on the public schools of removing from them an important branch of education. If agricultural education were to be turned over to agencies outside the local public schools, it would be easy to argue for turning over other types of education until little would be left of these schools. I am not at all concerned that this is going to be done. We may as well reconcile ourselves to the idea that agricultural education is to have an increasing part in our public schools and begin to work out more satisfactory relationships between this type of agricultural education and that sponsored by the agricultural colleges.

Some of Dr. Chandler's conclusions seem to trace to the limited conception of education implied by the title of his article. If we are only to "help farmers with knowledge" we shall go about the job one way; if we are to provide education in agriculture as a part of a general education, our procedure is quite different. Certainly agricultural education is much more than getting the newest sound facts about agriculture to the farm people.

Dr. Chandler's article provides further evidence that increased contacts between agricultural scientists and educators would be desirable. Perhaps, as one result of these contacts, the educators could answer the question: Why do scientists who reason well in their own fields often become inexact and unreliable when they stray outside them?

H. M. HAMLIN

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ANTS AS PROBABLE AGENTS IN THE SPREAD OF SHIGELLA INFECTIONS

ANTS have not been incriminated as vectors of pathogenic bacteria affecting man, though medical entomology abounds with citations of flies as carriers of many species of bacteria. Even cockroaches have been suspected, but ants have not been mentioned. No reference is found in the available literature as to their role in this respect.

Theoretically, if flies can convey pathogens mechanically from infected to non-infected material, other insects should be able to do likewise. For some reason, ants, in tropical or subtropical regions where they abound, are prone to be accepted rather as a harmless invader to be combatted solely on an esthetic basis. They are driven from sugar, candy or other foods which are then consumed with little thought of contamination.

Recently in this laboratory, in the course of experiments on native food as a culture medium for Shigella, ants were found to carry these organisms. The original observation which led to this limited series of experiments was purely accidental. Portions of the native food, rice and beans cooked together with onions and tomato sauce, were inoculated with various strains of Shigella to determine whether this food was a favorable medium for the growth of the pathogens and thus a source of the dysentery so common in Puerto Rico. Following a 24-hour incubation of the plates streaked from this food, which had been inoculated with Flexner strains of Shigella, they were read, covered and left inverted on the laboratory table until the next morning. At that time unusual growths of non-lactose fermenting colonies, later identified as Shigella, were observed in a pattern similar to miniature rabbit tracks. Examination revealed a few ants on the table, leaving the plates. These were caught and allowed to walk on sterile MacConkey and S.S. agar plates which, on incubation, produced a growth pattern similar to the original.

Since it was impossible at the time to produce a laboratory ant-hill for control purposes, it was necessary to rely on those entering from the hidden colony. Many were caught as they made their first appearance in the laboratory, about six feet from the inoculated plates. They were allowed to walk across sterile plates and then were placed in large vaseline-rimmed pans. Others leaving the infected food were caught three to five feet away and, on exposure to sterile plates, produced pure cultures of Shigella. Since the MacConkey and S.S. agar are selective media, inhibiting *B. coli* as well as some Gram-positive organisms, the plates made from the entering ants were sterile 24 hours later. From this it was concluded that ants, placed in this container, were free from Shigella or Salmonella.

Food inoculated with *Shigella flexner* V was placed in one container. The ants fed readily during a period of four hours, when the food was removed and sterile plates introduced long enough to allow ants to walk over the surfaces. These plates produced *Shigella flexner* V. Twenty-four hours after feeding on the infected material, sterile plates were again introduced. These, too, produced the typical growth of Shigella marking the footprints of the ants. The process was repeated in forty-eight hours, but on these last plates no colonies appeared. About twenty ants of this group were then macerated and inoculated on plates; others placed in nutrient broth, which again failed to produce Shigella. This work was repeated with like results.

From these simple experiments it may be deduced that ants may carry bacteria on their feet from one place to another for at least 24 hours after feeding on or traversing infected material.

The ants used in this experiment were kindly identified by M. R. Smith, of the U. S. Bureau of Entomology, as tropical fire ants, *Solenopsis geminata* (F.).

This species is very common in Puerto Rico and is found in practically every kind of environment.

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MEDICAL ORTHOEPY

THE scientist who employs an instrument seeks to master the technique of its use in an effort to gain therefrom the maximal advantage. To a physician language is an indispensable tool, but once he has begun the study of medicine he rarely strives to increase his dexterity in its use. He comes to lay all stress on meaning and heeds not pronunciational faults in speaking or careless construction in writing. The errors in speaking are the more glaring since formal training in the pronunciation of medicine's specialized vocabulary is neither given to nor required of the would-be physician. It is rarely, too, that the physician has had formal training in the art of public speaking, although, to a greater or less extent, he must practice that art throughout his life. Should the medical school demand that training, stimulants would be less necessary for the audience which would remain awake at a scientific meeting. The snoring at post-prandial and late afternoon lectures would be diminuendo instead of crescendo.

Since the problem of correct pronunciation is the more pressing I shall confine myself to it. That English pronunciation is capricious and irregular is well illustrated by the story of the Frenchman, who, after a period of diligent application to the peculiarities of English pronunciation, concluded that a week in London would act as a fillip to his flagging interest were he to spend it in attending some interesting plays. Accordingly on arriving in London he betook himself to the theatrical district and stopped to read the bill-board on one of the playhouses. He read: "'Strange Interlude'—Pronounced Success." His comments at that would suffer by translation.

Although the problems of orthoepy are many, they are well summarized in a quotation from the latest edition of the Merriam-Webster dictionary:

> From the nature of the case, when the essential facts are considered, correctness of pronunciation must be a flexible term. It is perhaps as accurate a definition as can be made to say that a pronunciation is correct when it is in actual use by a sufficient number of cultivated speakers. This is obviously elastic, depending both on knowledge—not always obtainable—of the number of users, and on judgment as to the cultivation of the speakers. Mere majorities, without consideration of historical linguistic background and regional distribution, are not decisive.

This problem is not simplified when every user of a technical term considers himself qualified to determine its pronunciation, even though his knowledge of linguistic background may be nil. It would be as illogical for the physician to acquire his medical knowledge from a dictionary as for a careful user of language to acquire his knowledge of pronunciation from a physician. The arbitrament of the lexicographer is certainly to be preferred to chaos. In the coining of new terms to describe new knowledge, which is certainly the right of any educated user of a vital language, it is better to leave the problem of pronunciation to the lexicographer. With his knowledge of precedent he is better qualified in deciding the "correct" pronunciation by bringing to bear whatever semblance to logicality the flexible rules of orthoepy permit.

A few illustrations will justify the need for this plea. These illustrations include only terms for which but one pronunciation is recognized by the accepted dictionaries. Most of these orthoepic errors could be avoided by a thorough grounding in Latin and Greek, but it is a moot point as to whether the smattering of classical studies still required by some schools is of any value. As a former college instructor in the classics I consider it even more debatable as to whether a more extensive capital investment of time in classical studies would pay sufficient cultural dividends to make the investment sound. The time were better spent in subjects designed to broaden the cultural outlook of a future physician during that period of his education when his time is not so completely devoted, of necessity, to pure science. A very common error in the pronunciation of medical terms is to render as diphthongs vowels which should be sounded separately. This error has obtained so long that this pronunciation has gained recognition for some words. Thus, protein, correctly a three-syllable word, has been accorded but two; so also with caffeine, rabies and others. However, for such words as oubain, sparteine, codeine, caries, facies and others correct speech demands the pronunciation of all three syllables. Syndrome, analogous to epitome, should have all vowels sounded, but it has so long been mispronounced as a two-syllable word that lexicographers remark that pronunciation in medicine. There is a large class of words which is wrongly accented. Until recently correct speech placed the accent in abdomen on the second syllable. The word has been so long abused that the most recent dictionaries give the accent on the first syllable as a second choice. Words compounded with "acetyl-" should have the secondary accent on the first syllable but they are seldom accorded that measure of respect. The accent is usually placed incorrectly on the second syllable. Sulfonamide should be accented on the penult but it is usually the antepenult which we hear accented. Cerebral and verte-

bral are almost invariably mispronounced because they are accented on the second syllable instead of the first, as they should be. Dyspnea and related words are shamefully treated. The "p" is usually disregarded, although it should be sounded and the first syllable is incorrectly accented when the accent should be on the second.

These illustrations could be multiplied indefinitely, but it would serve no good end. This plea will have fulfilled its purpose if more attention be paid to lexicographic pronunciation and less to intuitive. It is true a vital language is continually changing, but it is dubious if changes emerging from ignorance constitute progress. Much would be accomplished if medical school staffs emphasized orthoepy more, since it is from them that future physicians first learn medical terms. Their present carelessness in speech is a sorry contrast to the thoroughness and scope of their scientific training. The man who speaks with care arouses in his audience a greater feeling of confidence in the potential accuracy of his scientific conclusions.

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A SEVEN-YEAR-OLD BANK SWALLOW

IN the summer of 1937 it was our good fortune to recover as a return at Oneida Lake, N. Y., a banded bank swallow, *Riparia r. riparia*, the known age of which was at least six years.[1] This bird had been banded by us as a nestling on June 30, 1931, about one-half mile from the point of its recovery. Until the present writing it has remained the oldest known individual of its kind.

Now, with the capture, in May, 1942, of adult banded bank swallow No. 35-59216, the record for the longest known life-span in the species rests with that individual. A brief history of this swallow, so far as it is known, is herewith offered as a further contribution to ornithological knowledge.

Adult bank swallow No. 35-59216 was banded as an incubating individual from a burrow in the south bank of Fish Creek near Oneida Lake, N. Y., on May 27, 1936. Its mate was not banded.

On May 21, 1937, this swallow was recovered (Return 1) as a laying or incubating individual in a burrow only a few yards from the one it occupied the preceding season. Its mate also was a return, banded on May 24, 1935. Incidentally, this is the only occasion on which we have recovered two banded return bank swallows at the same time from the same burrow. This burrow was 23 inches deep, 20 inches below the turf and contained an unlined grass nest.

[1] Dayton and Lillian C. Stoner, *Bird-Banding*, 8: 175–176, 1937.

At the time of recovery No. 35-59216 registered a body temperature of 109.6° Fahr. and weighed 14.4 grams. The body temperature of its mate was 108.0 degrees and it weighed 17.7 grams. In this species there are no external differences between the sexes, but the discrepancy in weight between these two individuals strongly suggests that No. 35-59216 is a male. Since this swallow was at least one year old at the time it was banded in 1936, it was now at least two years old.

On May 24, 1940, No. 35-59216 was again captured (Return 2) from a burrow in the same colony as before and at most only a few yards from the ones it had occupied in 1936 and 1937. The burrow was 30 inches deep and 14 inches below the turf. An *unbanded* individual shared the burrow, indicating that the return swallow had different mates, at least in 1937 and 1940. The body temperature of No. 35-59216 registered 107.8 degrees and it weighed 14.2 grams. This bird was now at least five years old.

On May 25, 1942, No. 35-59216 was once more recovered (Return 3) as an incubating individual in the colony in which it had been captured in 1936, 1937 and 1940. And the burrow which it occupied was not more than a few feet from the site of those occupied by it in those seasons. This burrow was 28 inches deep and 24 inches below the turf. On this occasion the body temperature of the swallow registered 109.8 degrees and its weight was 14.3 grams. This bank swallow had now attained the age of at least seven years.

Certain essential facts regarding bank swallow No. 35-59216 may be thus briefly summarized: It was banded as an incubating adult when at least one year old; at the time of its latest recovery in May, 1942, this swallow was at least seven years old. Between its first capture in 1936 and its latest recovery it had been recaptured as a return in 1937 and 1940. All recoveries were in the same sector of the colony as that in which it was first captured. This swallow had made at least six round-trip journeys between its nesting ground and its winter quarters and had a different mate in at least three of the four seasons that it was captured.

It is of interest to observe that among the 282 banded bank swallows which we have recovered as returns within the inclusive seasons 1924–1942, 18 have been approximately one year old, 170 at least two years old, 58 at least three years old, 23 at least four years old, 11 at least five years old, 1 at least six years and 1, the individual above reported, at least seven years old. The results of our banding investigations to date indicate that the probable average life span of this species is from 2 to 3 years. Moreover, the tendency for a given individual to return season after

season to the exact spot in the colony where it has once nested is exhibited to a remarkable degree.

NEW YORK STATE MUSEUM, ALBANY, N. Y. DAYTON STONER

ALBANY, N. Y. LILLIAN C. STONER

A STING-RAY ATTACK ON A MAN ON THE UPPER AMAZON

I SPENT the years 1921–1931 in geological exploration of the upper Amazon Basin, with headquarters at Iquitos in Peru, during which period I witnessed an attack of a sting-ray on a man and cared for the patient. Dr. E. W. Gudger, who is preparing a paper to answer the question, "Is the sting-ray's sting poisonous?", became much interested when I told him of my observation. He states that authentic personal records of such occurrences are rare and that he has found none for the Amazon, where such attacks may be expected commonly to occur. Urged by him, I have prepared this brief account of what I witnessed.

In January, 1925, in working up stream through shallow stretches of a tributary of the middle Rio Morona in northwestern Peru, Fabriciano Vela, my faithful orderly, while wading barefooted beside my canoe in water about twelve inches deep, on a sandy bottom, was struck in the sole of his right foot by a sting-ray. Upon a bottom of this sort, rays are often extremely common in quiet shallow streams of the Upper Amazon Basin of eastern Peru, and not infrequently wading men are struck after these creatures have become alarmed and confused as many plunging, splashing feet churn and roil the water about them. Fabriciano, appearing to be in great pain almost immediately, cried out in terror and despair as he staggered to a nearby sandy beach to fling himself upon the sand and, holding the wounded foot with both hands, to writhe about in agony, tears trickling down his cheeks despite his resolution not to make a spectacle of himself. I had been told repeatedly that this was the most excruciatingly painful experience which could befall a man in the Amazon jungle and my unfortunate assistant made that contention very convincing indeed.

I had already learned that the Brazilian proprietary medicine known as "Balsamo Divino" was considered the most effective in the treatment of such a case and proceeded with it in the approved manner as soon as possible. This colorless, slightly oily liquid compound of apparently several aromatic ingredients, rather well masked by carbolic acid, suggests the "phenol sodique" of my boyhood days. With a cotton swab saturated with this remedy undiluted, I carefully cleaned and bathed this rather deep stab-wound, and then bandaged the foot lightly so as to hold another similarly saturated swab in place upon the wound while several drops in water were given orally. He had been struck, as I have just said, rather deeply at something of an angle as his foot was raised in stepping forward but the bleeding seemed to me less than one might reasonably have expected. Though he continued for a time in extreme, almost unendurable pain, there was no considerable swelling, nor did he experience nausea, headache nor indeed any systemic symptoms. After several hours, during which the bandage over the wound was kept moist with the medicine, he became quiet and in a short time the wound had healed without sloughing, and indeed without inflammation of any importance, thanks probably to the antiseptic properties of the phenol.

Another boy, Edmundo Araujo, who was with me for a time, was, while on the Rio Ucayali, very grievously wounded by a large ray which drove its terribly venomous spine into the sole of his foot in such a manner that it passed between the metatarsal bones and emerged upon the upper surface. I was not a witness, but he told me later that he had had no idea that one might suffer so fearfully.

HARVEY BASSLER

AMERICAN MUSEUM OF NATURAL HISTORY

QUOTATIONS

SCIENCE AND THE CENSOR

SCIENTISTS in general and physicians in particular will be disturbed by the correspondence which has passed between the postal censor and Dr. J. McKeen Cattell, editor of SCIENCE, and which appears in the current issue of that journal. That censorship in war is necessary no one will deny. But was the censor justified in deleting from SCIENCE an item on a new sulfa drug which can be used with good effect in such intestinal infections as dysentery, because our enemies in tropical regions might learn how to return the afflicted rapidly to the fighting line? From time immemorial military surgeons have made no distinction between friend and foe in dealing with wounds and disease. In 1917 both the Surgeon General of the Army and the Secretary of War decided that for humanitarian reasons publication of information about an antitoxin developed in this country to combat the bacillus of gas-gangrene, then highly destructive on the Western Front, was permissible. Thousands are now dying of typhus in occupied Middle Europe, but if the censor has his way they can not be saved by the dissemination of any new knowledge acquired here.

We detect no such narrowness of view in the few German medical and scientific publications that have reached this office since the attack on Pearl Harbor, nor in the pages of *Nature*, which is apparently permitted to exercise its discretion, and which prints communications of the very type that have been expunged from SCIENCE. The censor was certainly on slippery ground when he deleted references to indium because that metal can provide a satisfactory lining for shaving-cream and toothpaste tubes. The Germans know as much about indium as we. So with the suppression of an item on a method of spraying walls of mines to prevent mercury poisoning. Some of the material to which the censor objected in the case of SCIENCE had been published in newspapers from Maine to California, so that nothing whatever was gained by deletion. To make matters worse, there is no appeal from his decision.

Probably Dr. Cattell is right in holding that the editors of scientific periodicals are better judges of what may or may not be of value to the enemy than technically incompetent postal authorities. If the policy to which he objects is carried out consistently, new scientific books and periodicals must be suppressed. Astrophysicists, biologists, plant and animal breeders, organic chemists who are trying to isolate vitamins and hormones, designers of new electron microscopes, inventors of materials that will resist fire, mathematicians who devise techniques that can be applied in solving the problems of designing engineers—all make discoveries that have some application in totalitarian war.—*The New York Times.*

SCIENTIFIC BOOKS

AN ENTOMOLOGICAL JOURNEY IN ARABIA

In the High Yemen. By HUGH SCOTT. 260 pp. Illustrated. London: John Murray, 1942.

HUGH SCOTT, formerly of the University Museum at Cambridge, now on the staff of the British Museum (Natural History), has long been known as an explorer and a keen student of problems concerning the evolution and distribution of insects. He made great collections of the insect fauna of the Seychelles Islands, in the Indian Ocean, and in the course of years got nearly everything worked up, with the assistance of numerous specialists. More recently, he explored Abyssinia and brought home very extensive collections. The work in Abyssinia naturally brought up questions concerning the life on the opposite or Asiatic side of the Red Sea. The botanist, Schweinfurth, had (1891) published a comparison of the plants of southwest Arabia with those of northern Abyssinia, and noted that while the two floras had much in common, there were some striking differences. The insects, with so many diverse genera and species, might be expected to throw much light on the various problems, but they were little known, so far as Arabia was concerned. It therefore seemed an excellent project to explore the mountainous region of southwest Arabia, and make collections as adequate as the available time permitted. This plan was approved by the British Museum (Natural History), and Dr. Scott, with his companion, E. B. Britton, set out in 1937, going first to Aden. They soon found out that it would be very difficult to do the work proposed, owing to restrictions imposed by the native rulers of Al Yemen and Asir. The latter country could not be entered at all, and although entry into the Yemen had been promised, the permission was withdrawn. It was only after prolonged negotiations that Yemen was opened to the expedition, and then it was only with limitations. Thus permission to climb the highest mountain was denied. In spite of all difficulties, the expedition was very successful and the technical results will occupy Scott and his associates for many years. The scientific reports will all be published by the British Museum, and the first part has already appeared.

The book is very well printed, with very numerous excellent illustrations from photographs, although there is a note to the effect that "The paper and binding of this book conform to the authorized economy standard." It may surprise some to see such a book appearing in the midst of the war, but it is the policy of the British to keep scientific and cultural interests alive, and moreover, as the only really modern account of social, political and economic conditions in the little-known region explored, the narrative may have considerable value in relation to the war. The general conclusion seems to be that while the rule of these Asiatic provinces is arbitrary and in many respects medieval, there is progress in certain directions. Thus, although in general it is so difficult to enter the Yemen, there is an excellent medical missionary, Dr. Petrie, stationed at the capital, and his aid is sought to the limits of his capacity, patients coming in from all over the country. Although Scott and Britton were disappointed in the attitude of the ruler, who found it a little difficult to believe that their interests were purely entomological, they could not deny that in the present state of the world there was every reason to regard the European powers with suspicion. However, in the Aden Protectorate to the south, controlled by the British, there is what might be called home-rule and it does not appear that the British influence is other than beneficial.

It is not possible to modernize these backward countries in a short time, and the process, though justified on economic and commercial grounds, may be far from beneficial. One feels that the "infiltration" of Europeans that is really needed is not that of the commercial or military types, but that of scientific men and Christian missionaries, who are committed to the international point of view and have no reason for seeking profit at the expense of the people. In particular, the medical missionaries, as I have observed them in many parts of the world, represent genuine progress and enlightenment, whatever we may think of their theological dogmas. Scott, commenting on the work of Petrie and his associates, says: "I would emphasize the immense value of their work from every point of view, for the direct alleviation of suffering, for the betterment of understanding between the nations represented on either side, and on the highest spiritual grounds."

Scott records that he left the country with real regret, having received much kindness at the hands of the people, coming to regard many of them with affection. Also, although his collections were very extensive, the insects numbering about 27,000 specimens, it was obvious that there was very much more to be done, awaiting new collectors and new opportunities.

T. D. A. COCKERELL
UNIVERSITY OF COLORADO

REPORTS

THE ROYAL OBSERVATORY, GREENWICH[1]

THIS year's report of the Astronomer Royal refers to the work of the Royal Observatory during the period May 1, 1941–April 30, 1942. London suffered few air attacks during this time, and no further damage to the observatory has occurred. Daylight observing is still carried on at Greenwich, but the larger instruments will, of course, remain dismantled for the duration of the war.

The public time service continues to function from two out-stations, each maintaining, in case of breakdown at the other, a complete time service involving transit observations, clock maintenance and transmission of time signals to the Post Office of the B.B.C. The Rugby vernier signals, which are the precision British time signals, have up to the present normally been transmitted from Station B, since the clocks at station A are mounted in temporary fashion and suffer from serious mutual interference. During the year, however, the three free-pendulum clocks and a quartz clock at station A have been remounted in a specially constructed building, and it is hoped that their behavior will now be sufficiently improved to allow this station to share regularly in the transmission of the rhythmic signals. The published corrections to the Rugby signals and to foreign signals are now based on some or all of nine clocks—seven Shortt clocks and two quartz oscillators—mounted in various parts of the country. By working on a "mean clock" and by making certain changes in the routine of signal transmission, a distinct advance has been made in the precision of the Rugby signals, the value of which as a day-to-day frequency standard has thereby been increased. Accurate allowance for land-line lag is now made before each signal is transmitted. Comparison of the signals against the clocks, or of one clock against another, is now facilitated by the use of thermionic panel units which eliminate the variation of lag inevitable with mechanical relays. Intercomparison of the clocks has shown that in the matter of small erratic changes of rate even the best free-pendulum clocks are inferior to quartz clocks.

The Chronometer Depot has settled down into its new quarters, and repair, rating and issue of chronometers and watches to the Royal Navy have continued without interruption. A vibration machine constructed in the observatory workshop has been brought into use for testing aircraft watches under service conditions. Tests of the effect of magnetic fields of strengths up to 8.5 gauss on the rates of chronometers and watches have been instituted, no doubt with war conditions in mind, and are now nearing completion.

The last report of the observatory stated that work with the Airy transit circle had been terminated after ninety years continuous observation. Since then, news has been received of the destruction of Poulkovo Observatory during the bombardment of Leningrad. This will be such a serious loss to fundamental positional astronomy that observations are to be resumed with the old Greenwich instrument on a restricted program, including particularly transits of the sun. Minor damage to the housing of the instrument has therefore been made good, the instrument has been overhauled, and work will be resumed shortly. Analysis of previous observations with this instrument arranged according to wind direction shows that declinations south of the zenith are measured larger by about 0.10″ when the wind is northeast than when it is southwest. The observations of latitude variation had already given a similar result. This agreement shows the advisability in positional astronomy of applying locally determined latitude variations so as to eliminate spurious annual terms due to systematic sea-

[1] From *Nature.*

sonal fluctuations in wind direction. The division errors of the fixed circle of the new reversible transit instrument show on analysis a cyclic error, recurrent every 2½°, which may reach 0.19″; thus emphasizing the need of determining the division error of each graduation.

The photoheliograph observations show that the expected decline in solar activity continues, though there have been four notable periods of resuscitated activity. Of the four big spot groups the area of which exceeded 1,000 millionths of the hemisphere, two exhibited bright eruptions in Hα light which were later followed by great magnetic storms on the earth. Assuming that the magnetic storms were caused by solar corpuscles emitted at the time of maximum intensity of the chromospheric eruptions, the mean time of travel of the particles is calculated as 20 hours.

The Nautical Almanac Office continues its essential work. Last year's report referred to the destruction by fire of the type and plates for most of its publications: during the early part of the year under review printing delays due to this circumstance and to a change of printing contract caused a dangerous accumulation of arrears. The Nautical Almanac for 1942 was in fact not published until November 3, less than two months before the date to which it refers, but the arrears are being wiped off so satisfactorily that the 1943 edition appeared on April 3. The failure of communications with many of the other ephemeris offices has led to a small increase of computational work; but duplication is avoided so far as possible by interchanging information with such of the offices as are still free to collaborate. The war has hastened a decision which would have been reached in any event, namely, to abandon the indiscriminate provision of occultation reduction elements. The observations for 1938 and 1939 show that the majority of the computed reduction elements are never in fact used, owing to the particular occultation not being observed; and of the remainder most are used once only. In the future the office will do the individual reductions for all observations actually made, provided that observers will do that portion of the reduction depending solely on their position and that of the star. A revision of the Air Almanac has recently been planned in conjunction with the Air Ministry: the effect will be to redistribute the data on the two pages allotted to each day, one of which now becomes a "night" page and the other a "day" page. The change should result in greater simplicity in use, at the expense of a slightly larger page. The present R.A.F. Star Charts are based on a recent investigation carried out by the office on the optimum method of identification of the stars used in aerial navigation.

The Magnetic Department of the observatory, in addition to the regular daily observations of the magnetic elements, is at present engaged in preparing charts for the Admiralty showing the iso-magnetic lines in declination, horizontal intensity, inclination and vertical intensity. The declination charts, of which the previous edition was published in 1937, are now ready; those for *H* and dip, for which the previous editions are dated 1922, are well advanced. Vertical-intensity charts are a novelty.

Features of the year's weather observed at Greenwich include a very wet August (4.146 in.) followed by an unprecedented lack of rain in September and October, during which only 1.41 in. fell. The winter was conspicuous for cloudiness, the sunshine recorded being only 55 per cent. of the average, and for consistently low temperatures in January and especially in February, which had a record number of days (twenty-six) on which temperatures below freezing were recorded.

Visitors to Greenwich Park will miss the famous 24-hour clock dial at the shattered main gates of the observatory, and the daily fall of the time ball; but the familiar domes are still there, though somewhat perforated, and the Wren building still stands guard over the all too characteristic bend in the river. Meanwhile, as the familiar, never-failing "six-pips" testify, the work of the Royal Observatory goes on.

SPECIAL ARTICLES

THE EFFECT OF HUMIDITY ON BETA STREPTOCOCCI (GROUP C) ATOMIZED INTO AIR

Microorganisms in atomized droplets pass through a critical period in changing from an aqueous to an atmospheric state of suspension. The duration of this transient stage naturally depends upon air humidity. Sampling methods, adequate for studying subsequent mortality of residual organisms in static experimental atmospheres, may yet be too coarse for distinguishing such effects.

In the development of a dynamic method for study of disinfection of atomized air-suspended microorganisms, some eighty experiments in design of apparatus, development of techniques and exploration of bacterial behavior have been performed. An experiment consisted of two or more runs in altered atmospheres, each run involving six simultaneous volume and settling samples from two consecutive atmospheric exposures.

Confusion reigned until lethal effects of humidity changes in exposure chambers were evaluated. Their magnitude had not been suspected. High humidity

neutralized and low humidity masked the disinfecting action of propylene glycol vapor. Disinfection was most apparent at intermediate humidities.

Seven series of experiments representing comparable relative humidities, concentration of disinfectant and time of exposure have been tabulated (Table I). Normal room humidity existing during the late winter and early spring is represented by ±; added humidity by +; and deficiency due to dehumidification by - sign. The results are reported in terms of lethes—a lethe being equivalent to bacterial removal by one displacement of the atmosphere within the chamber. Air change is a ventilating term which simplifies expression of air disinfection.

TABLE I

LETHAL EXPOSURE

		First Exposure				Second Exposure			
Series	Experiments	Time seconds	Glycol conc mg/1	Humidity	Lethes	Time seconds	Glycol conc mg/1	Humidity	Lethes
VII	3	60	.00	±	.10	60	.00	±	1.75
VII	"	"	.00	–	1.75	"	.00	–	1.26
I	5	10	.00	±	1.50	10	.00	±	.04
I	"	"	.05	±	4.27	"	.05	±	.07
II–IV	11	60	.00	+	.50	6	.00	±	1.07
II–IV	"	"	.30	+	1.50	"	.05	±	3.74
V–VI	5	60	.00	+	.55	6	.00	+	.14
V–VI	"	"	.30	+	1.20	"	.05	+	.18

Results on beta streptococci (Group C), averaging 3.6 lethes with and 1.27 lethes without glycol vapor, corroborate British results on aerosols of hexylresorcinal dissolved in propylene glycol[1] and American results on propylene glycol aerosols without hexylresorcinal[2] and later results on propylene glycol vapor.[3] Expressed in terms of lethes, these laboratory findings can readily be converted into sanitary ventilation equivalents.

Uniform dilutions of glycol vapor and humidity (Series I) were more lethal on first than on second exposure. Where first exposed to higher concentration of propylene glycol vapor and moisture (Series II–IV) lethes were higher on the second exposure. In humid air (Series V–VI) neither exposure showed marked lethal effect, but combined glycol vapor and humidity (second runs) seem to neutralize each other. Dehumidification with calcium chloride, on the other hand (Series VII), gave lethal results comparable to propylene glycol. Exposure in the apparatus following glycol experiments showed lethal lag, resulting perhaps from condensation or absorption on interior surfaces.

The possibility that results reported by English workers might be due less to toxic effect of hexylresorcinal aerosols, and those reported by American workers due less to the toxicity of glycol vapor than to desiccation produced by this hygroscopic substance, can not be overlooked. Disagreement among various workers[4] on the mode of disinfection, together with low toxicity of propylene glycol in aqueous solution, raises questions which await better understanding of relationship to humidity.[5] Retabulated on the assumption that the results are due to dehydration (Table II), they fall into alignment.

The decrease in effectiveness of a fumigant with increased humidity runs counter to accepted theory of fumigation; neither does disinfection rate (disregarded in Table II) conform to the normal law of equal proportionate bacterial decrease in equal time intervals. Mortality seems to occur at critical phases rather than to follow the normal logarithmic type of death rate.

TABLE II

LETHAL DEHYDRATION

Series	Experiments	Lethes with differing humidity		
		Humidified	Average humidity	Dehumidified
VII	3	..	1.85	** 3.00
I	5	..	1.54	* 4.34
II–IV	11	..	1.58	* 5.24
V–VI	5	.69	* 1.39	...
Average	24	.69	1.59	4.29

* Assuming desiccation by propylene glycol.
** By calcium chloride.

These results are preliminary to a more detailed description of the method and to a more thorough study of air disinfection.

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[3] O. H. Robertson, C. G. Loosli, T. T. Puck, E. Bigg and B. F. Miller, SCIENCE, 94: 612, 1941.

[4] A. Trillat, *Rev. de path. comp.*, No. 510 (March): 292, 1939; R. J. V. Pulvertaft, G. C. Lemon and J. W. Walker, *Lancet*, 443, 1939; A. T. Masterman, *Jour. Hygiene*, 41: 44, 1941; A. E. Williamson and H. B. Gotaas, *Industrial Medicine*, 11: 40, 1942; O. H. Robertson, E. Bigg, B. F. Miller, Z. Baker and T. T. Puck, *Transactions of Assoc. of Amer. Physicians*, Vol. LVI, 1941.

[5] A. H. Baker and C. C. Twort, *Jour. Hygiene*, 41: 117, 1941.

[6] These laboratories are supported by a grant from the Commonwealth Fund to the University of Pennsylvania for studies in the prevention and control of air-borne infection. These experiments were conducted at the Henry Phipps Institute.

ISOLATION OF A NEW "CAROTENOID" FROM RAT LIVER

DURING an investigation of the influence of carcinogenic hydrocarbons upon the hepatic vitamin A stores of mice and rats,[1] there was observed not only a marked difference in response by the two groups of animals, but even an unlikeness in the chemical composition of the unsaponifiable fraction of the livers. A study of this latter interesting dissimilarity has led to the isolation of a new carotenoid-like substance.

The mice and rats were killed by a sharp blow on the head and the livers removed at once. These organs were then macerated, saponified and extracted with peroxide-free ethyl ether, according to the technique of Davies.[2] Chloroform solutions of the unsaponifiable fraction of mouse livers were invariably colorless, while those derived from rats were always a light yellow.

The unsaponifiable fraction of the livers dissolved in chloroform was treated with a saturated solution of antimony trichloride in the same solvent (Carr-Price reaction), and the colored mixture resulting was examined immediately, and at short intervals thereafter, for the appearance and disappearance of spectroscopic absorption bands. Mouse livers usually exhibited only one readily visible absorption band for vitamin A, that at 620 mμ. However, by concentrating the chloroform solution so that 1 cc contained the unsaponifiable fraction of 3 to 6 livers, a faint band at 570 mμ could be seen also.

On the other hand, the unsaponifiable fraction of rat livers showed a stronger band at 565–570 mμ besides the 620 mμ band for vitamin A. The persistence of these bands was somewhat dependent upon the concentration of the unsaponifiable fraction and also upon the amount of added antimony trichloride. Nevertheless, both bands (620 mμ and 565–570 mμ) made their appearance immediately with the addition of the reagent, although the 565–570 mμ band proved more enduring. Although the mice were fed Rockland Mouse Pellets, and the rats received Purina Dog Chow, a reversal of diets failed to alter the above reactions.

The "carotenoid" was isolated as follows: The residue of the unsaponifiable fraction of the livers from 4 to 6 mature rats was taken up in 50 to 70 cc of petroleum ether (30°–60°). This extract was then added to a 500 cc Erlenmeyer flask, containing approximately 50 gm of finely powdered Kaolin (China clay), which had previously been well wetted with petroleum ether. Adsorption of the yellow substance apparently occurred instantaneously, for the Kaolin at once assumed a purple color. However, the mixture was shaken and allowed to stand for a few minutes.

The supernatant petroleum ether solution, now colorless, was decanted and the Kaolin washed three to four times with 50 to 70 cc portions of petroleum ether to remove any unadsorbed unsaponifiable substances. After separation of the greater part of the petroleum ether, the adsorbed "carotenoid" was eluted with absolute methyl alcohol. The colored substance dissolved easily in the remaining petroleum ether-methyl alcohol mixture. Final separation from the Kaolin was accomplished by filtration through Munktell's OA. paper.

When the solvents were removed from the eluate on a steam bath and the Carr-Price reaction applied to the eluate in chloroform at 0°, an absorption band at 585–587 mμ was seen. This band was too transient to be observed at room temperature. It is not known whether isomeric changes occurring during adsorption and elution can explain the shift in absorption from 565–570 to 585–587 mμ.

The "carotenoid" was crystallized as follows: After evaporating the methyl alcohol-petroleum ether mixture from the eluate on the steam bath, the orange-yellow residue was dissolved in 95 per cent. alcohol with heating. The cholesterol was removed by adding a hot alcoholic solution of digitonin and allowing the mixture to cool to room temperature. The cholesterol digitonide was filtered off, and the filtrate evaporated to dryness in a vacuum desiccator. The residue was then dissolved in ethyl ether, any excess digitonin being left behind.

After removing the ether on a steam bath, the residue was dissolved in a few cc of carbon disulfide, and the solution poured into 10–20 cc of hot absolute methyl alcohol. The "carotenoid" crystallized at – 12°, and the crystals were separated by filtration at 0°, in a cold room. Approximately 10–12 mg of the new "carotenoid" was obtained from five rat livers. A solution of the "carotenoid" in chloroform did not show any maxima from 350 mμ to 850 mμ when examined spectrophotometrically, which rules out the carotenes. The "carotenoid" is solid at 0° and at this temperature showed an absorption band at 585–587 mμ when treated with a cold solution of antimony trichloride.

Carbon and hydrogen were determined by micro combustion.[3]

Analysis

3.885 mg substance: 4.325 mg H_2O and 11.475 mg CO_2
3.185 " " : 3.580 " " " 9.310 " "
Calculated for $C_{16}H_{30}O$. C 80.59, H 12.69
Found. " 80.52, " 12.45
" 80.40, " 12.70

The "carotenoid" is quite soluble in chloroform, ethyl ether, carbon disulfide and petroleum ether. It

[1] C. Carruthers, *Cancer Research*, 2: 168, 1942.
[2] A. W. Davies, *Biochem. Jour.*, 27: 1770, 1933.
[3] Micro combustions done by Dr. Carl Tiedcke, New York, N. Y.

is less soluble (25°) in absolute methyl alcohol and in ethyl alcohol.

The absorption band at approximately 570 mμ has been observed by others, but its significance was never before determined. Van Eekelen, Emmerie, Julius and Wolff,[4] and Willstaedt and Jenson,[5] have postulated that the 570 mμ "chromogen" is another vitamin A. Karrer and Morf[6] suggested that hepaxanthin may give this same chromogen. On the other hand, Brockmann and Tecklenburg[7] found that oxidation products of vitamin A (*in vitro*) yield an absorption band at 570 mμ.

Further work is in progress to determine the structure of the new "carotenoid." Whether it is an intermediate metabolite of vitamin A or of β carotene, remains to be determined.

SUMMARY

A new carotenoid-like substance has been isolated from rat liver. A method for its separation and some of its properties are given.

The authors wish to express their gratitude to Dr. H. F. Seibert, of the S.M.A. Corporation, for the samples of the β carotene used in these studies.

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MOCK-DOMINANCE AND HYBRID VIGOR

Two plant varieties, one of which has twice as many internodes of half the length as the other, will be equal in height. A hybrid between these varieties will exceed their height by 12½ per cent. if internode number and length are exactly intermediate in inheritance, *i.e.*, if dominance is lacking. Here, then, is an apparent dominance for plant height, or an example of hybrid vigor in its pristine sense, that is not the result of dominance in its genetic meaning. This effect may conveniently be called *mock-dominance*. It results from the fact that plant height is determined as the product of number and length of internodes and from the relations that obtain between the means of products and the product of means.

These relations are simply shown by considering the products A′B′ and A″B″. Their mean, of course, is:

$$\frac{A'B' + A''B''}{2} \tag{1}$$

The product of the means of the two components, on the other hand, is:

$$\frac{A'B' + A''B'' + A'B'' + A''B'}{4} \tag{2}$$

Now:

$$(1) = (2) \text{ when } A' = A'', \text{ or } B' = B'', \text{ or both} \tag{3}$$
$$(2) < (1) \text{ when } A' > A'' \textit{ and } B' > B'', \text{ or } \textit{vice versa} \tag{4}$$
$$(2) > (1) \text{ when } A' > A'' \textit{ but } B' < B'', \text{ or } \textit{vice versa} \tag{5}$$

The relations indicated by (3), (4) and (5) apply generally to all characters that are the products of component dimensions which, in turn, are intermediate and independent in inheritance. It is evident that (3) describes what frequently may be expected in crosses between similar varieties, and (4) what may be expected when varieties similar in proportions but differing in size are crossed. The mock-dominant effect described by (5) is the expectation for characters in crosses between varieties differing in type with respect to those characters. The importance of this effect will depend upon its magnitude and its generality of occurrence. Adequate data on these points are not available.

Examples of characters in which this effect may frequently be manifest come at once to mind. The yield of grain per plant in cereals is the product of the number of grains and their average weight. Many-seeded varieties often tend to have relatively small grains and *vice versa*. Plant height has been referred to. Individual leaf area is the product of length and width. Longer corn leaves often are narrower than shorter leaves, particularly for extremes in length and width. Crosses between contrasting types should have leaves with larger areas than the mean of the parents. If the parent having leaves with smaller areas has more leaves than the other parent, there would be a cumulative mock-dominant effect on total leaf area per plant. The weight of ear in corn is the product of length, diameter and density. Length of ear, in turn, is dependent on number and length of the cob internodes, and density is even more complex.

The characters mentioned are among those the measurements of which have been largely used in the quantitative determination of hybrid vigor. They also are characters generally conceded to be controlled in inheritance by numerous genes lacking dominance. The same principles will apply to rates which are the products of subsidiary rates. Thus, growth rate is the product of the rates of cell division and of cell enlargement. Again, intense chlorophyll and small leaf area from one parent combined with weak chlorophyll and large leaf area from the other would establish a basis for superior photosynthesis in the hybrid.

[4] M. Van Eekelen, A. Emmerie, H. W. Julius and K. L. Wolff, *Acta Brevia Nederlandica*, 1: 8, 1931.

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There is an ever-increasing body of evidence pointing to the interaction of dominant favorable genes as a sufficient explanation for hybrid vigor, and there is no intention here to explain this phenomenon on the basis of mock-dominance. The conditions necessary for its occurrence would not exist universally enough. Again, estimates based on available measurements indicate that the effects would be too small to account for any substantial part of such increases as are obtained, for example, in crosses between inbred lines of corn. Finally, it is doubtful whether even linkage and interference could excuse the failure to recover strains equal to the hybrid more frequently than has been the case in the past.

On the other hand, mock-dominance seems entirely adequate to account for the small excesses, of the order of 2 to 5 per cent., above the parental means that are reported from time to time in connection with breeding results. Whether it is a correct explanation in any case could be determined rather easily and definitely. When it is, such case will be eliminated from need of further consideration in connection with hybrid vigor in its broader sense, thus simplifying that problem. Moreover, it will be just those hybrids that are vigorous because of mock-dominance that will offer the greatest possibilities for isolating vigorous, true-breeding strains.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE PHOTOELECTRIC RELAY

THE combination of a mirror galvanometer and a photoelectric relay is ideal for the control of many systems where the null condition is to be maintained. The relay circuit described by Soller, Goldwasser and Beebe[1] was tried in the Kansas Agricultural Experiment Station milling research laboratory for the control of an adiabatic calorimeter for the measurement of the heating of damp wheat. Their circuit relies upon insulation leakage for the grid leak of the amplifier tube. Wide variations in the humidity of the air plus large voltage fluctuations in the electric current available caused frequent failure of the relay. This difficulty was overcome by rectifying the control circuit so that a grid leak of from 2 to 10 megohms could be used. The diode of a type 75 tube served for the rectification, while the triode replaced the 6C6 amplifier of the original circuit, so that the use of an additional tube was avoided.

With the introduction of the 117L7GT tube in 1940, considerable simplification was possible, since this tube has sufficient voltage amplification that the preliminary amplifier tube is not ordinarily necessary, and it also contains a rectifier section, which can be used to supply D.C. grid bias. Fig. 1 shows the circuit and specifies parts which will be satisfactory for most applications. Sensitivity may be increased by using higher values for R_3: 20 megohms should not cause instability. Adjustable sensitivity may be obtained by substituting a 1 megohm volume control for R_2. If a vacuum phototube is used instead of the gas-filled type 918, R_1 may be omitted and R_3 may be increased even to several hundred megohms if necessary for the required sensitivity.

The 117L7GT tube is rated at 45 milliamperes, but when operating on A.C. as in this circuit, the output can not be expected to be more than 30 to 35 milliamperes. For this reason the relay S_1 should operate on 30 milliamperes or less at not over 90 volts. The G. M. Laboratories type DD60B(64–14)CW relay has given good results, as has the Struthers Dunn midget relay wound for 50 volts or for 90 volts D.C. Ordinarily the screen resistor, R_4, can be omitted altogether, but some tubes have been found which overheat and fail to control if this is done, so 1,000 ohms is recommended as a minimum. If a relay operating on less than 15 milliamperes is used, R_4 should be increased to reduce the plate current of the tube to about the value required by the relay: 10,000 ohms will usually be satisfactory for relays using from 10 to 15 milliamperes.

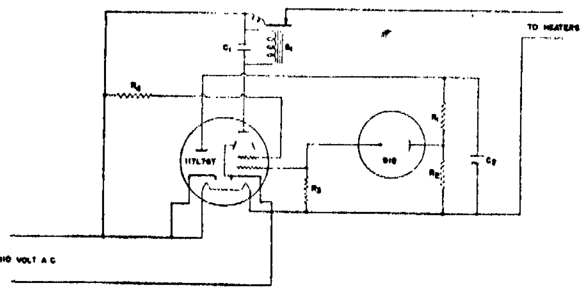

FIG. 1. C_1, electrolytic condenser, 4 or 8 mfd.; C_2, paper condenser, 0.1 mfd.; R_1, carbon resistor, 300,000 ohm; R_2, carbon resistor, 1 megohm; R_3, carbon resistor, 2 megohm; R_4, carbon resistor, 1000 ohm; S_1 relay. RCA type 918 gas-filled phototube. Type 117L7GT radio tube.

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[1] T. Soller, S. Goldwasser and R. A. Beebe, *Jour. Am. Chem. Soc.*, 58: 1702–1706, 1936.

Contribution No. 36, Department of Milling Industry, Kansas Agricultural Experiment Station.

A NEW AGAR MEDIUM FOR DROSOPHILA CULTURE[1]

TEACHERS and investigators who have been rearing *Drosophila melanogaster* on banana-agar medium and who are now concerned about the predicted banana shortage will be interested in the writer's experience in developing a war-time formula in which he has substituted canned tomato paste for banana. Oddly enough this substitution, mothered by necessity, produces a medium seemingly superior to either the banana or the cornmeal medium so long in use. It was Professor C. E. Myers who suggested that a tomato product might offer possibilities as a banana substitute. This suggestion came as a result of his observation that during the fermentation of tomato pulp for seed-saving great numbers of fruit-flies are attracted to the pulp barrels.

A two-month experimental period in the preparation and use of tomato-paste medium has provided time in which to test proportions of ingredients of the formula, to observe the properties of the resultant medium and to note the size and vigor of the yields obtained. The formula recommended is as follows, with the customary drop of Fleischmann's yeast suspension to be added to each culture when the flies are introduced.

1000	cc	water
100	gm	tomato paste
100	gm	white corn syrup
20	gm	granulated agar-agar
1	gm	Moldex

In the writer's opinion the advantages of the use of this medium are as follows:

(1) Tomato paste is available at grocery stores as a standardized product in six-ounce cans which may be purchased in quantity and stored in the laboratory, thereby eliminating the nuisance and uncertainty of obtaining bananas properly ripened at any or all seasons of the year.

(2) The cost of tomato paste plus corn syrup is not greater than that of bananas and the labor involved in its preparation is of shorter duration and far less "messy."

(3) The red color imparted to the medium by the tomato paste provides a background against which students may readily observe the progress of their crosses, for on the bright red agar the tiny white eggs are discernible and the movement of the first larvae easily detected.

(4) The cultures do not dry out, for there is ample moisture in the medium to support the culture over a period of three to four weeks and to keep the absorbent paper sufficiently moistened for successful pupation.

(5) The use of Moldex makes it possible to store at ordinary room temperature unautoclaved medium for two weeks or longer in plugged culture bottles which were sterilized before filling. With the addition of a drop of yeast suspension these bottles are ready for use at any time during a two-week period.

Optimism in regard to the timeliness of this formula must be tempered by the fact that at any moment its usefulness may be restricted by additional war-time shortages in agar, in syrup or in cans for processing tomato paste. However, it is strongly felt that the use of this formula will outlive the need for it.

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[1] Authorized for publication on May 28, 1942, as paper No. 1104 in the Journal Series of the Pennsylvania Agricultural Experiment Station.

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SCIENCE NEWS

Science Service, Washington, D. C.

ALTERNATING CURRENTS

THE story of a pioneer in alternating currents of electricity was told at Vancouver, B. C., at the convention of the American Institute of Electrical Engineers by the pioneer himself, Dr. Frederick Bedell, now consulting physicist of Pasadena, Calif.

The present occasion is the fiftieth anniversary of the first paper presented to the institute by Dr. Bedell and his collaborator, A. C. Crehore, on alternating currents, which cleared up for the first time misunderstandings and confusions in this field. It has been called a "pioneer paper" and "a classic in its field."

Dr. Bedell is the inventor of oscilloscope with linear time axis, which pictures the alternating current wave form on a fluorescent screen. It is now an indispensable instrument in every field including telephony and television where alternating, fluctuating or transient currents are involved. His pioneer research and inventions in bone conduction have enabled many people to hear who never heard before.

For these two outstanding achievements, Dr. Bedell was honored in 1940 with the award of Modern Pioneer on the American Frontier of Industry by the National Association of Manufacturers. "In 1890," Dr. Bedell said, "alternating current was just plain freak; it did not follow Ohm's law and 'clogged' itself in its circuits." Nobody understood it. Everyone was afraid of it.

The first installation in 1886 put 500 volts on the transmission line and then stepped it down to 100 volts by the then newly-born transformer. The length of the line was 4,000 feet. But electricians said, according to Dr. Bedell, "If a high potential primary circuit of 500 volts or more were used to distribute electricity throughout a community, there was grave fire and life danger." A few years later a bill was introduced in the Virginia legislature to limit alternating current voltage to 200, alternating current being considered more deadly than direct. This is a far cry, Dr. Bedell remarked, from the 287,500 volts of the Boulder Dam plant of to-day.

The chief worry of engineers in the early nineties was wave form "whatever that might be." They knew from the principles of sound that a pure tone is given by a "sine" wave, that any departure from this form means the presence of harmonics which may have 2, 3, 4, or many more times the frequency of the fundamental note. Such harmonics in an alternating current wave could be dangerous, for the inductive effects increase with the frequency. If the circuit happens to be in tune with any one of them, the voltage may reach very high peaks and fireworks on the switchboard may result—and often did.

But what is a tuned circuit? Why is the current "clogged" in some circuits, while the voltage jumps to distressing heights in others? The answers to these and many other questions were given in the 1892 paper of Bedell and Crehore. Its 72 pages contained the first clear and mathematically correct theory of the flow of alternating currents both in transient as well as in steady conditions. Vector methods and circle diagrams, now so common, were introduced, and the first use was made of complex quantities. Later that same year, the contents of this paper were incorporated in a book, "Alternating Currents," by Bedell and Crehore, which long served as a standard text-book, and even to-day is an excellent introduction. The same can be said of Bedell's "Principles of the Transformer," published in 1896.

But to apply the theory, a knowledge of the wave form was necessary, and no instruments existed that could determine the form of an electric wave that lasted 1/20th of a second or less. From 1893 on Dr. Bedell and others devoted themselves to this task. Various mechanical and electrical methods were devised. The most successful of these was the Dudell oscillograph about 1900. This consisted of a very light element suspended in a magnetic field produced by the current to be investigated. This element moves back and forth in tune to the alternations of the field, and makes it possible to photograph the curve of the wave form on a moving film. This instrument is still useful for low frequencies. But however light the suspended element, it still has weight, and its oscillations lag behind those of the field, and above a certain frequency cease altogether. For high frequencies a weightless vibrator was needed. This came with Dr. Bedell's cathode ray oscilloscope in 1927. The vibrator is an electron stream which will follow the most rapid oscillations even up to the ultra-high frequencies now used in radio. Cathode ray oscilloscopes were not new, but they had lacked a reliable time axis. They only produced a figure on the screen from which the wave form could be mathematically deduced. Dr. Bedell's invention remedied this defect. The wave form known, the harmonics present could be determined, and the theory showed how to suppress them or at least to reduce them to harmless dimensions.

The amounts that could be safely allowed were also determined. In 1915, Dr. Bedell as chairman of the subcommittee on wave form of the Standards Committee began setting up wave form standards to make alternating current machinery safe. Penalties were imposed on the different harmonics according to their frequencies, in this way, as Dr. Bedell put it, making the penalty fit the crime.

With these standards, which have been revised from time to time, fireworks have disappeared from the switchboards and elsewhere. The wild waves have been tamed, and no one is now afraid of alternating currents.

THE EXPECTATION OF LIFE

FANTASTIC as it may sound, we are outliving our expectation of life. Statisticians for the Metropolitan Life Insurance Company point out that men and women born in 1876, for example, had an expectation of life when they were born of 41.4 and 44.6 years, respectively, on a statistical basis. But the average length of life for men and women born that year turned out to be 46.3 years

for men and 50.6 years for the women. The figures are for England and Wales, but the principle applies in this country as well. This extra lease on life has been gained because of the advances of science and the standards of living.

The United States to-day has 2,900,000 more potential soldiers, men between 20 to 44 years old, than it would have had if it had not been for these life-saving improvements.

Many a man alive to-day knows that he owes his life to an operation or medical treatment—the sulfa drugs or insulin, for example—which has been developed during his lifetime. Many thousands of others owe their lives more indirectly to the advances of science. Of the 900,000 men and women aged 65 years alive in the United States to-day, 300,000 owe their lives to such advances. If conditions prevailing at their birth had continued, those 300,000 would not be alive.

The term "expectation of life" is not always used in its exact sense, the life insurance statisticians point out. "Strictly speaking," they state, "the expectation of life at any age is the prospective average number of years of life remaining to persons of that age, provided that the death rates at each age remained constant at their prevailing levels. Thus if we say that the expectation of life for a white male 10 years old in 1940 was 57 years, we mean that the members of the large group of boys of age 10 in that year would, on an average, survive 57 years, if the death rates at each age of life remained unchanged as of 1940."

CASES OF POISONING IN WAR PLANTS

THAT tetryl, chemical relative of TNT, is producing thousands of cases of poisoning in war plants, is reported by the *Journal* of the American Medical Association.

As production of explosives for the armed forces goes into high gear, an increasing number of poisoning cases are expected—odd cases of sickness with which the medical profession has been unfamiliar in peace-time practice. Symptoms usually occur after the second or third week of exposure. They usually consist of loss of appetite and nausea, coughing or sneezing, nosebleed, and—most significant of all—a characteristic inflammation of the skin. Anemia is also present in a good many cases. Yellow coloration of the skin of these war workers is not a symptom, but merely a staining of the skin.

Observations made on 1,258 cases by Dr. Leon J. Witkowski, Dr. C. N. Fischer and Howard D. Murdock, of Chicago, reported in the *Journal*, emphasize that the reactions are not only local, but affect the system as well. Of the war plants investigated where tetryl is processed about 23 per cent. of the workers were affected.

Although many workers were found to eventually develop a tolerance to the explosive after a number of weeks, the illness is not to be neglected. Physicians have already devised measures to protect health and avoid lost time in the war effort.

The physicians making the report emphasize the necessity of controlling the tetryl dust found in the plant atmosphere. This may be aided by conducting certain operations in small closed rooms separated from the rest of the plant. Cleanliness, ventilation, and temperature below 72 degrees Fahrenheit, are also important. Dietary measures, which have been recommended by some, consisting of taking milk or vitamin C, do not appear to be of great value to date. Lotions and ointments have been successfully used by physicians to allay the skin inflammation and the anemia is controlled by standard methods of treatment.

Use of great quantities of tetryl in certain defense areas has introduced a new occupational hazard—a challenge that can be met, when symptoms are first noticed, by cooperation of the workers and industrial medicine.

BUTYL RUBBER TIRES

BUTYL rubber tires in actual tests on New Jersey highways have shown a life of 20,000 miles if kept below a maximum of 40 miles an hour, was reported by J. P. Haworth and F. P. Baldwin, of the Esso Laboratories, before the Buffalo meeting of the American Chemical Society.

Some plants for the production of this type of rubber are already in production. Others are under construction. By a year from this fall the total production of butyl rubber will reach an annual rate of 130,000 tons.

Possibilities of "tailor-made" rubber for the different parts of a tire were pointed out. In the average light car tire, weighing about 12 pounds, only about four pounds is in the conspicuous part, the tread. Requirements for tread are different from those of side wall, and these in turn differ from those of carcass and inner tube. Synthetic rubbers can be given properties to suit the uses to which they will be put, which is not possible with natural rubber.

Perbunan, a highly specialized kind of synthetic rubber made of butadiene and acrylonitrile, was described by three other chemists of the Esso Laboratories, R. A. Moll, R. M. Howlett and D. J. Buckley. Acrylonitrile, a derivative of ethylene, comes, like butadiene, from oil and natural gas. One of its ingredients, hydrocyanic acid, can also be manufactured out of natural gas plus nitrogen from the air.

Perbunan's special claim to consideration is its high resistance to oil and gasoline, which makes it well adapted for use in self-sealing tanks for fighter planes, linings for filling-station hose, gaskets for oil pumps, and any other jobs involving exposure to oil.

It is also highly resistant to wear and quite resilient. This would make it an excellent tire rubber; but it is difficult to handle in manufacturing processes, so that its cost is high—somewhere between two and three times that of natural rubber. It should, however, make excellent tread blocks for tanks, a use that does not involve so much hand work as the preparation of tires.—FRANK THONE.

ITEMS

THE volcanic structure of the Galapagos Islands off the coast of Ecuador, now occupied by American troops, provides natural harbors. In spite of its name, Wreck Harbor, on the coast of Indefatigable Island, is said by geologists to be a safe and excellent approach to the shore.

Before the Galapagos acquired vital importance as a Pacific base for protection of the Panama Canal, they had long been an historic spot frequented by zoologists. It was here that Charles Darwin's famous idea occurred to him, like Newton and the apple. Only in Darwin's case, it was the sight of strange, unique forms of plant and animal life—giant turtles and uncouth sea lizards—which crystallized his theories of evolution through natural selection. Sixteenth-century Spanish navigators were so impressed by these giant turtles, often four feet long, that they gave the islands the Spanish name for "tortoise." Since the nearest relative to the Galapagos tortoise is a fossil found in Cuba, geologists believe the islands were once part of Central America, even though they are now 500 miles west of Ecuador, in South America. They are composed of twelve large, and several hundred small, islands, with many volcanoes still actively erupting on their shores.

SMOKELESS powder and synthetic rubber can be made cheaply and abundantly, using alcohol from watery wastes now poured down the sewer. The economics of the method, which by-passes the expensive distillation process, were explained before the Buffalo meeting of the American Chemical Society by Dr. Donald F. Othmer and Dr. R. L. Ratcliffe, of the Polytechnic Institute of Brooklyn. Waste liquors from paper mills and other industrial plants, as well as sawdust, straw, cornstalks and other agricultural wastes, contain sugars capable of being fermented into alcohol. But the solutions are so thin and watery that the fuel needed for distillation is worth more than the alcohol that could be obtained. Key to the riddle is fusel oil. Fusel oil dissolves alcohol but will not mix with water. So this toper's enemy is put to work getting the alcohol out of the watery wastes. Subsequently a chemical divorce between the alcohol and the fusel oil is arranged. A similar use of fusel oil can be made in getting acetone and other valuable industrial solvents out of solutions until now considered too thin to be profitably worked.

HOPE of controlling at least to some extent future influenza epidemics that may add to the horrors of war appears in a report to the American Medical Association by Dr. Joseph Stokes, Jr., and Dr. Werner Henle, of the University of Pennsylvania Medical School. A vaccine protected 43 out of 44 boys who were directly exposed to influenza. They inhaled through aviation oxygen masks a vapor of fluid from hen's eggs that contained a strain of influenza A virus. These germs were freshly isolated from a baby who had died with an overwhelming influenza infection. But only one boy caught the disease. Of 28 unvaccinated boys who breathed this same influenza germ-laden vapor, ten had attacks of influenza. The vaccine that gave such striking protection might not be able to stop an epidemic of influenza, even if it were possible to vaccinate the entire population. The vaccine protects against influenza A but there are other types of influenza that occur in epidemics against which the vaccine could not give protection.

SCIENCE

VOL. 96 FRIDAY, SEPTEMBER 25, 1942 No. 2491

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

AGRICULTURAL SCIENCE AND THE PEOPLE'S WELFARE[1]

By Dr. E. C. AUCHTER

RESEARCH ADMINISTRATOR, U. S. DEPARTMENT OF AGRICULTURE

I AM going to talk to-day not as a citizen of one country addressing the citizens of other countries, but rather as one scientist talking to other scientists. The concepts and methods of science, including our own agricultural sciences, are still international; they cut deep under the conflict that has now spread over the world. And the faith of science is international; it is that the truth, which science is forever seeking, must ultimately prevail. If it does not prevail now, it is partly because we do not yet know enough of the truth and not enough people are convinced, or even aware, of that which we do know. Meanwhile the scattered fragments of truth that science has discovered can be perverted, and are perverted, to cruel and brutal ends—as when modern technology, a clean-cut product of science, is used to bring whole peoples under the domination of a small group of power-hungry men and to destroy millions of human beings.

But I think there is not a scientist in this audience who would not agree that this *is* a perversion, and who does not feel horror and shame, deep down in his being, that science is so perverted. It is not what we, as agricultural scientists, want. We want to do everything we can to prevent this kind of perversion in the future. We want science to be used to serve the welfare of the people of the world. We know that it is a

[1] Address given at the Second Inter-American Conference of Agriculture, Mexico City, July 6, 1942.

powerful tool to advance human welfare. It can help us to feed, clothe and house ourselves better than the human race as a whole has ever done in the past—and to be healthier and stronger and saner—and to adjust ourselves better to our environment, and to one another as individuals in a society. Science can do these things by helping us to know the truth about the world in which we live—and about ourselves as human beings. "Ye shall know the truth, and the truth shall make you free." The fundamental faith of scientists has never been better expressed than in those simple words, spoken two thousand years ago.

In spite of all the shortcomings of our knowledge, we know enough to-day so that we should be far freer than we are of want and misery, suffering and fear. Our duty as agricultural scientists, then, is threefold: First, to keep on everlastingly seeking for more of the truth, each of us in that field in which our particular work lies; second, to see to it that whatever truths we discover become as widely known as possible; and third, to advance the use of these truths for human well-being.

Sometimes I think we are too modest about that second duty; we hesitate to talk about our discoveries lest it sound like boasting, with the result that they are sometimes neglected or forgotten and, like Mendelism, have to be rediscovered. And we are often too timid about the third duty. We feel that our job is to discover the facts and that the job ends there. Some scientists feel that they are not concerned, as scientists, with how, when or where the facts are applied. The result is that they may be misapplied, even completely distorted—and science gets the blame. I do not say that we can entirely prevent this; I know we can not, because all the scientists in the world are relatively a small handful of people. But we can *help* to prevent it by taking a much stronger, more positive interest in the use made of science by society.

Who should take this interest more than the scientists? After all, it is our work that is used; it plays an enormous part in forming the physical environment and the mental atmosphere of our time. We have the strongest motives for seeing that it is used as universally as possible to create better conditions for human beings. And what is even more important, to make all of us better human beings—wiser, more understanding and more tolerant because we see more of the truth.

This need has now become critically urgent because we are at a turning point in human history. We must build a post-war world that will not be torn apart every few decades by its own inner strains and stresses. We must do this or face a future more destructive than even we of this generation can conceive. The time has come when no scientist can sit any longer in a nice ivory tower, believing that the truths of science by their very nature are something apart from the practical affairs of men. There will be no one even to discover what these truths are if all the ivory towers are blown up by bombs and their occupants are shot by firing squads. That is what we do not intend to permit.

Such thoughts as these are in all our minds; they are a sort of undercurrent in our work in this year 1942. But our immediate concern, of course, is with the everyday problems that face us as agricultural scientists, and my object is to discuss some of the broader aspects of these problems.

Agricultural Science Now Faces a Huge Task

Agricultural science is bound to find itself in a strengthened position as a result of recent events. A short while ago some people felt that it had done its work only too well; it had enabled farmers to increase production to the point where they could no longer dispose of all they produced at a profit. Actually, of course, this was simply another proof of the great power of modern technology. Give it a job to do, like making two blades of wheat grow where none ever grew before or enabling one man to do the labor of five, and it will do the job. Meanwhile, society, including our system of distribution, has to be so ordered that hungry people are able to get the bread—or any other product—that modern technology can produce in abundance. We can not create a powerful tool like technology and then try to throttle it with old-fashioned forms and ideas. We have to use science to advance along the whole front—or else go backward. And once we start going backward, we run a grave risk of returning to something like barbarism.

To-day there is no doubt in any one's mind about the need for science in agriculture. Vast armies have to be fed, clothed, housed and kept healthy. Our allies need enormous quantities of agricultural products. Our industrial workers must be well nourished to produce efficiently. The purchasing power of consumers has increased. Imports of critical commodities have been cut off; we must produce them in the Americas or create substitutes. And meanwhile there is a shortage of agricultural labor in the United States which must in part be made up by technical proficiency. None of these problems can be solved without making full use of all we know about scientific methods—and finding out as much more as we can as quickly as possible.

Nor will the present emphasis on agricultural science end with the end of the war. We shall still have a very big job to do. Much of Europe is starving and in ruins. Asia, Africa, Australia have all suffered in greater or less degree from the blight of war. Immense areas and millions of people will need to be re-

habilitated. To rebuild an exhausted world will necessitate making full use of agricultural science.

At no time have we been faced by so great a challenge. To meet the situation adequately will require the best we have to give in the way of energy and brains. The wisdom and foresight we apply to our work during the war and post-war period of world emergency will be influential not only in having the value of agricultural science fully recognized for a long time to come but in actually shaping the world.

What are some of the things we need to do in conducting our research to meet present needs and lay the foundation for a better future?

The Need for Maximum Efficiency

For some time my own task and that of several of my associates has consisted mainly in following through on a few urgent problems connected with the immediate needs of the war. Getting started on the production of Hevea rubber in South and Central America and of guayule rubber in the Americas and exploring the possibilities of other sources of natural rubber that could be grown in the Western Hemisphere is one of these problems. Working out processes for making synthetic rubber substitutes from agricultural products to help meet the present emergency is another. Still another is the speeding up of new ways of processing and packing foods to save shipping space and still supply the demands of overseas shipment and our armed forces, and to make up for the shortage of tin formerly used in cans and now diverted to military needs. Another has been to develop Western Hemisphere sources of important drugs, fibers and oils which we formerly received from the Orient.

These are jobs that have to be done as quickly as possible. They have meant working under pressure, concentrating scattered research facilities and personnel on a single problem and reducing what we call red tape—the ponderous procedures of government agencies—as much as we can in order to get quick results.

This suggests the first point I want to bring out in connection with agricultural research as a whole. We need to make a critical study of our research procedure to see where we can do more of this kind of thing—cut corners wherever possible, eliminate slow and cumbersome procedures that have grown up as agricultural science became divided into more and more special compartments, and bring people together for quick, common action. We scientists have had our own ways of doing things, very thorough but sometimes rather slow ways, and we were not going to let any one who did not know the necessities of science interfere with them. There are, of course, many things that can not be speeded up in scientific research; but I am convinced that there are also places where we can rid ourselves of excess baggage and strip down to a more clean-cut basis that will enable us to proceed faster and more efficiently. This is the time to do it. We can not afford to be slow in meeting the problems of human welfare that face us all with increasing urgency.

We Should Lead as Well as Follow

There is a second point of quite an opposite kind, however, in connection with this war work. We must beware of the temporary pressure of public opinion—which operates very strongly on a public research agency—to drop certain projects or certain lines of work that seem to us very worth while. I am reminded of this particularly in connection with the work on natural rubber. The Bureau of Plant Industry in our Department of Agriculture has been studying the sources of natural rubber for the Western Hemisphere for many years. As far back as 1921 our scientists foresaw the situation we have to-day. "Suppose," they said in effect, "we were to be cut off from the supplies of rubber in the Far East; we ought to be ready to produce it nearer to our own doorstep. Otherwise we might find ourselves in a very serious situation at a critical time."

This caution undoubtedly seemed far-fetched to a good many people, and there were unquestionably sound economic arguments against developing natural rubber here. Perhaps the scientists seemed like dreamy, impractical fellows. Nevertheless, they kept on studying rubber-bearing plants, doing what work they could, even if it was only a modest amount. It was this far-sightedness that has enabled us to go ahead rapidly with the present Hevea project in South America and the guayule project in the Americas. These "impractical" scientists laid the groundwork for what we are doing to-day.

The point is that the scientist is often the shrewdest judge of what needs to be done in his own field. In this case, even though there was no immediate need to develop sources of natural rubber in our part of the world, he knew how long it takes to breed and evaluate rubber plants, and find out where they will grow best, and work out the best methods of growing them in a new environment. "Let us be prepared," he said, "at least to the extent of knowing how to do the job if we have to." We can see now that he was right.

The lesson, so far as agricultural research in general is concerned, is that the research agency should carry along certain projects when it is convinced, after rigid self-examination, that they have an insurance value for the future, even though they may not have popular appeal at the time. The research worker must do more than follow the trends of current events; he also has

a responsibility as a leader who looks ahead. Where scientific work is closely and directly tied up with the public welfare, as ours is, this responsibility is especially great. If we exercise it wisely, we can be sure of public approval in the long run.

THE NEED FOR FREEDOM OF INQUIRY

Closely related to this point—the need to carry along certain projects whether or not they seem to have immediate value—is the question of carrying on basic research.

Many people think of basic research as purely theoretical; they are unable to see, for instance, that it has any practical bearing on farm problems. "Why spend time and money on it," they ask, "especially in a critical period like this?" To the scientist, the answer is simple: The whole progress of science depends on filling in the gaps in our knowledge of the nature of things. To the layman, however, it is not so obvious that much of the structure of modern science, with its vast number of practical applications in our daily lives, is based on a comparatively few fundamental discoveries.

In the case of basic research, we can seldom tell in advance what these practical applications will be; we simply know that we are on the trail of a fact which explains something not previously understood. But once the fact is established, the practical applications —sometimes very surprising ones—are likely to turn up in abundance. Three cases in our own work occur to me because they are very recent.

It has been known for a long time, of course, that plants respond among other things to temperature and also to intensity of light. A few years ago it was discovered that they also respond to length of day. After this fundamental discovery was made, a good deal of experimental work was carried on to find out the nature of the responses, and many important facts were uncovered, the upshot of which is that the growth, flowering and fruiting characteristics of many plants —including many of economic importance in our agriculture—vary with variations in the length of the light period to which they are exposed.

Originally this may have seemed like an interesting botanical fact not of great practical importance. But note some of the developments to which it has led.

Instead of expensive and lengthy field experiments, we can carry out comparatively inexpensive experiments in a greenhouse, under controlled light and other conditions, which show the range of adaptability of various kinds of plants; and on the basis of these experiments we can predict with considerable certainty what plants will do well in a given locality. If certain varieties of plants prove not to be well adapted to the day length and other conditions there, we can breed varieties of high quality and great uniformity that will be adapted.

We used to be almost entirely dependent on Europe for our supply of sugar-beet seed. By determining the rather exacting temperature requirements for seed production by sugar beets, we were able to find localities in our own country where large crops of seed could be produced. In fact, we now save a great deal of time and labor by growing the beets for seed as a winter annual, the cycle being much like that of winter wheat. Not only are we independent of European sources, but the seed we produce is better adapted to our conditions than that from Europe because it has been bred for resistance to the plant diseases prevailing in our country. In the breeding work, light exposure as well as temperature is manipulated in the greenhouse so that we can bring our selections to the seeding stage in the minimum time.

There are many other practical applications of this essentially *botanical* discovery about the nature of plants. Onion varieties can be found or bred that will produce bulbs in a short-day region, others in a long-day region; likewise strawberries that will fruit abundantly in our long-day northern areas, others in the short days of our South. The same thing is true of other agricultural crops. Florists can hasten or delay the flowering of plants simply by controlling the light period in the greenhouse. And so on. All this means a better adaptation of production to the needs of both producers and consumers in a given area.

If I had more time, I would like to go into this matter in greater detail. For example, it was found recently that a few minutes of exposure to light near the middle of the dark period gave results similar to those from a full exposure. Grafting a single leaf of an Agate soybean, which blooms readily under long-day conditions, onto a Biloxi soybean, which requires a short day, enabled the Biloxi also to bloom under long-day conditions. Such facts as these open up fascinating fields for new explorations in plant chemistry and physiology.

The discovery of growth-regulating substances, generally called plant hormones, is another example of basic research that is now giving practical results. We carried this work along quietly for several years, treating various parts of plants—roots, stems, buds and flowers—with many different substances, some of which had marked effects of great theoretical interest; in some cases the natural behavior of the plant was completely altered. In the course of these experiments it was found that apple trees treated with a very dilute hormone solution would hold their fruit without dropping it far beyond the normal period. As a result, hormone spraying of apples is already becoming a standard orchard practice that promises to be of

immense value to producers in preventing the dropping of fruit before it has reached good size and color. This single application should save far more than all the money spent on all our hormone research. Yet it was not even dreamed of in the beginning of the research work; in fact, it was simply one of several by-products of the research job. I think we can say confidently that there will be many other practical applications of this work. One of them, already of considerable value, is the use of hormones to stimulate root development in cuttings of plants that ordinarily root with great reluctance. Another, so far tried only experimentally, is the dusting of blossoms to obtain fruit of better quality with such plants as the tomato.

The third example I want to mention briefly is waxy corn. In the course of research on the genetics of corn, a plant was developed with a peculiar waxy quality in the starch of the endosperm. It was of no practical use whatever, but because of its theoretical interest it was not discarded but carried along by the breeders. Now this curious corn promises to be of great value as a substitute for tapioca starch, the supplies of which have been cut off by the war.

The examples I have used have all come from the plant field, but similar ones could be given in practically every other field of agricultural science. Time permits mentioning only a few cases in which basic research has played a part in one way or another, though not always in as clean-cut a fashion as in the illustrations already mentioned.

In the animal-disease field, there is the discovery of phenothiazine as an anthelmintic. One of the remarkable things about phenothiazine is that it is effective for a considerable range of internal parasites in various classes of animals, whereas most anthelmintics are quite specific and limited in their usefulness. In addition, it can be administered more easily and conveniently than most anthelmintics. All in all, phenothiazine promises to be one of the most valuable aids we have in combating worm parasites, which as you know are a major enemy of livestock production. As part of the background of this development there were years of patient work studying the effects of parasites in the animal organism and testing many different kinds of drugs for their anthelmintic value.

Similarly, in our modern insect control work, there is a background of studies in the life histories of insects to determine at what points each one is most vulnerable to attack, as well as detailed studies of the physiology and functioning of the insect organism, especially in relation to the effects of various poisons.

In animal breeding, we are engaged in a major project to increase the production of our dairy herds by the wide-spread use of tested and proved sires. This is an undertaking of very large scope, and it would never have been started if our breeders had not been convinced, on the basis of a long, careful study of the fundamental genetic problems involved, that it could be successfully done—and that it would result in very worth-while economies in milk production.

Fundamental researches in the genesis of soils led to the development of the principle of ionic exchange or "base exchange." The practical results have been numerous and far reaching. We can now apply lime to acid soils accurately according to the needs of different crops and combinations of crops. Even more important, we can control irrigation much better. The formation of puddled alkali soils can be prevented, and alkali soils can be reclaimed through chemical treatments and the control of irrigation water and drainage.

In the field of human nutrition, there have of course been many interesting developments in recent years. One of them of particular importance to all of us in agriculture is based on what was essentially a piece of basic research in the dietary habits of large numbers of individuals, families and economic groups. Out of this has come a method of determining the nutritional status of whole segments of a population. This is immensely valuable not only in production planning but also in what I might call the statesmanship of human well-being. Before we can raise the nutritional level of a population or a group, we must know where they stand and what improvements need to be made—and this information has not hitherto been available.

In all these cases, either basic research precedes the practical applications of science, or a certain amount of this kind of research is found to be necessary somewhere along the line to clear up obscurities that block further progress. As public service agencies, our agricultural research institutions exist primarily to help agriculture solve practical problems. But the point I am making is that in research there is no single road to practical results. If we keep our eyes constantly and exclusively on what seem to be immediate needs, we miss some of the richest fruits of scientific work—the fruits that grow from the discovery of important fundamental facts.

This is not to say that we do not need to use good judgment in the choosing of research projects in a given program. We need to use the best possible judgment. But in the last analysis, it should be the judgment of scientists. This is the essence of scientific freedom or freedom of inquiry.

Perhaps that is what it gets down to—freedom of inquiry. This freedom is denied whenever an effort is made to use science solely for the support and aggrandizement of a special group. In the long run this is a terrible mistake. Freedom to explore all kinds

of facts wherever they may lead is absolutely necessary if science is to advance human welfare. It is a freedom worth fighting for.

The emphasis I have given to basic research and freedom of inquiry does not mean that we should pay any less attention than we do to homely experimentation directed toward solving everyday problems. On the contrary, most of our time will necessarily be spent on this kind of work. After the basic facts are discovered, there is always an immense amount of what might be called best-way research to be done. What is the best way to prune fruit trees? What is the best way to meet the mineral requirements of livestock? What is the best way to cook vegetables so they will retain their vitamins? The number of such problems is endless, especially since in every case the best way varies under different conditions of cost, available equipment, environment and final result desired. To determine all these best ways means carefully controlled, systematic experimentation, demanding much patience and frequently a great deal of ingenuity.

Coordination is Needed

The next point I want to emphasize is the need for coordination, briefly touched on earlier in these remarks.

I don't know how it may be here in Mexico City, but in the city of Washington, this period might well be called the Age of Getting Together. I have never seen so many gatherings of different groups to discuss urgent needs and decide on combined action to meet them. They are so numerous, in fact, that I sometimes feel as though I were not doing anything else but attend conferences.

This has its drawbacks, but it is a sign of the times. In a time of common peril, separate groups tend to pull together and act as one group to achieve a single aim.

We in the agricultural sciences are feeling this influence very strongly. It is a good influence. I hope and believe that we are at the beginning of a new time of closer cooperation and better integrated planning. Many of us have given lip service to this principle in the past, but we have carried it out only in a partial, half-hearted way. From now on we will be compelled to carry it out much more vigorously and wholeheartedly if we are to solve the pressing problems of the public welfare.

In the ordinary course of events, an agricultural problem might be tackled something like this: Perhaps the chemists see the problem first and approach it from the chemical standpoint. They work along for a couple of years and then find that there is a bacteriological aspect. The bacteriologists work on this for a few years, and discover that there is an entomological problem mixed up in it. After the entomologists have worked for a while, some one finds that the home economists should be brought in. Meanwhile each group works strictly along its own bureau or departmental lines, jealously guarding its bureaucratic prerogatives and fearful that the others will trespass on its ground. Perhaps at the end of ten years, the problem is finally solved.

Why not get the chemists, the bacteriologists, the entomologists and the home economists all together in the beginning and have them working simultaneously on parallel aspects of the problem, instead of end to end, separately and in sequence? In that way the job might be done in two or three years instead of ten. This is what we are doing now with more and more of our problems. The method is not new, of course, but its use is being accelerated by the conditions we all face to-day. We still have much to learn about this kind of integration, but as it is extended over larger areas of our work, the possibilities seem to me stimulating and inspiring.

I should like to mention briefly a research project that may serve as an example of the sort of coordination I have in mind.

As part of the background of this project, three facts are especially important. (1) Most agricultural research with crops has had as its ultimate object the production of the greatest quantity of a given product of a high market quality from a given acreage. (2) Recent work in the field of nutrition, however, has developed hitherto unknown facts which give us a new understanding of nutritional quality and its immense importance for human well-being. (3) There is ample evidence that food and feed plants grown on soils deficient in certain minerals—iron, copper, manganese, cobalt, phosphorus, for example—fail to supply enough of the deficient minerals to maintain good health. Human beings living on these foods suffer from serious physical disabilities; animals may actually die by the thousands.

These facts raise important questions: To what extent would it be possible for us to improve and insure high nutritional quality in food and feed plants as an objective in agricultural production, in addition to our older standard objectives of quantity and market quality? And how can health and human welfare be improved by adopting such objectives?

Recently, in cooperation with many states, we established a nutrition laboratory on the campus of Cornell University, in the State of New York, to study this question.

As you will readily see, it breaks down into a good many different parts because there are many things that may affect the nutritional quality of both crop and livestock products. For instance:

What does climate have to do with the vitamin or mineral content or other nutritional factors in the case of such farm products as vegetables, fruits and grains? What variations are due to differences in soil? What effects do soil amendments, such as fertilizers, have? What are the effects of other agronomic practices besides the use of fertilizers? Do different varieties of the same plant vary significantly in nutritional quality? If so, to what are the differences due—and would it not be possible to breed plants with superior nutritional value?

We have hardly more than begun this work, but so far I think we can say definitely that it will be possible to breed some plants at least that will have uniformly superior nutritional quality so far as their content of vitamins and minerals is concerned. That is not the point here, however. The point is that this project necessarily involves simultaneous work by scientists in many fields. We have brought into the picture outstanding experts in human and animal nutrition, in soils, in plant breeding, in plant physiology, in home economics and in public health problems. Each has vital contributions to make on different aspects of the whole project. As a result, I believe that we shall avoid the common danger of going too far in one direction while missing something of great importance in some other direction. The whole project, to my mind, is an excellent example of cooperative research focused on a common objective that not only has great scientific interest but should make a real contribution to human welfare through better nutrition.

We Need Social Awareness

The final point, which I wish to emphasize again, is the need for research workers to be very much aware of the relation of their work to the problems of human welfare.

We have perhaps taken this too much for granted. Science has accomplished so much in the modern world—its achievements are so evident all around us in the form of new products and new modes of communication, transportation, manufacturing, and so on—that we assume that of course it contributes to human welfare.

Yet we have been faced by the stark facts of poverty and unemployment in the midst of plenty—ignorance in an age of enlightenment—and finally, total war, meaning total destruction, in an age supposed to be dominated by science, which is essentially a builder and not a destroyer.

Can we, as scientists, look at the world to-day and say we have done all we could to make our work contribute to human welfare? Have we not been rather naive in assuming that our job was to do the particular piece of research in front of us, irrespective of how the results were used?

A discussion of these questions would take me very far afield. I am raising them simply to suggest that it is part of our business as agricultural scientists to try to understand and as far as possible anticipate human needs—social and economic needs—in our work. To take an immediately pressing example—what is the world going to be like after this war? How can the enormous productiveness of science be put to work to make it a better world to live in than the one before the war? How can we direct our work as scientists to prevent wars and to create peace, plenty and opportunity for far more of the world's people? Those are the kinds of problems we must face in our thinking and planning. There is no question but that the viewpoint and method of science can be a powerful factor in solving them.

The agricultural research institutions of the Americas constitute, in the aggregate, a very large body of scientific facilities and skilled personnel. Our big job in the years immediately ahead is to use our combined power and vision for the welfare of humanity—and when I say our, I mean those of us who work in the natural sciences as well as the economists. If we make this the unswerving intent and purpose behind our work as agricultural scientists, I am sure we shall find the means to contribute a great deal to a brighter future for mankind.

SCIENTIFIC EVENTS

RECENT DEATHS

Dr. Hector Russell Carveth, electrochemist of Niagara Falls, N. Y., died on September 7 of injuries sustained as the result of the explosion of a cement tank. He was sixty-nine years old.

Dr. John Arthur Wilson, consulting chemist, New York City, president of John Arthur Wilson, Inc., died on September 17, at the age of fifty-two years.

Daniel A. Lehman, professor emeritus of mathematics and astronomy of Goshen College, died on September 8, at the age of eighty-two years. He had been a professor at the college since 1906.

Sir John Macpherson, emeritus professor of psychiatry in the University of Sydney, died in England on August 14 in his eighty-fourth year.

Nature reports the death at the age of seventy-three years of Dr. Kurt Brandenburg, professor of special

pathology and therapy at the University of Berlin, editor of the *Medizinische Klinik;* and of Sir Montagu Sharpe, K.C., the well-known ornithologist, chairman of the Council of the Royal Society for the Protection of Birds, who died on August 23, at the age of eighty-five years.

THE AID OF SCIENCE IN PRODUCTION IN GREAT BRITAIN

In order to ensure that the fullest use is made of scientific and technical resources in the field of production, the British Minister of Production, according to *The Times,* London, has appointed W. A. Stanier, chief mechanical engineer to the London Midland and Scottish Railway; Dr. T. R. Merton, treasurer of the Royal Society, and Dr. I. M. Heilbron, professor of organic chemistry, Imperial College of Science and Technology, to his staff in the capacity of full-time scientific advisers. The official statement reads:

The field of activity of these advisers will be co-extensive with the responsibility of the Minister of Production. They will keep in close touch with the scientific advisers of the Service and Supply Departments, and will be available to assist the departmental organizations of scientific research and technical development. They will not supersede the departmental organizations, which will, for instance, continue to be responsible for the examination of new inventions and technical suggestions in their own fields.

They will be responsible to the Minister of Production, but will work under the immediate supervision of the Lord Privy Seal, acting on his behalf.

These appointments have been made with a view to completing the existing organization for scientific research and development which has been carefully built up over a number of years and operated with outstanding efficiency.

The Government has reviewed the whole position in the light of recent representations, and has decided that the creation of the post of Minister of Production affords the opportunity for this further measure of coordination which the Government believes will be to the national advantage.

THE SECRETARY OF THE ZOOLOGICAL SOCIETY OF LONDON

According to *The Times,* London, the secretary of the Zoological Society of London, Dr. Julian S. Huxley, has written to H. G. Maurice, vice-president and chairman of the council, resigning the secretaryship of the society and membership of the council. His letter is as follows: "I am writing to ask you to transmit to council my resignation as secretary to the society and member of council. I am sorry to have to do this, but as I had associated myself with the informal committee, and as the fellows have now voted against their nominees, I feel that no other course is open to me. Apart from this, I regret that there no longer exists that measure of mutual confidence and general agreement between myself and council which would warrant my continuing to hold the post of secretary. I am, of course, taking steps to find alternative accommodation, and shall vacate the official flat as soon as I have done so. In view of the misapprehensions which still exist concerning my own position, I am sending a copy of this letter to the press."

Dr. Huxley's resignation was received by the council of the society at their meeting on August 26, and at the meeting of fellows which followed, Mr. Maurice expressed his regret that "a man of such brilliant parts as Dr. Huxley should be of such restless genius as not really to fit in with the routine drudgery of an institution of this character." The council's personal relations with Dr. Huxley had always been very friendly.

Mr. Maurice announced that a resolution handed in at the annual general meeting advocating the establishment of a committee of council members and fellows to inquire into the administration of the society had been accepted by the council. This committee would investigate the suggestion that the society's original charter, in existence since 1829, was in need of reform. Members of the committee would be appointed at the next council meeting in a month's time.

MEDICAL AID TO CHINA

Helen Kennedy Stevens, the executive director of the American Bureau for Medical Aid to China, writes to Science as follows:

Apropos of Egbert H. Walker's suggestion in the July 17 issue that American scientists should save scientific publications for the future use of Chinese scientists whose own libraries have been destroyed, may I inform your readers that the American Bureau for Medical Aid to China, one of the participating agencies of United China Relief, for some time has been collecting text-books and journals for shipment to the Emergency Medical Service Training Schools in China and other institutions desperately in need of such literature. American physicians and institutions have been most generous in donating texts and journals which those in charge of Chinese schools and hospitals have asked us to obtain.

Unfortunately, now that the port of Rangoon and the Burma Road have been cut off, and there are such heavy demands upon the transport routes from India, it is inadvisable for us to continue to send books, but we are sending texts and charts on micro-film, which go by air mail and may reach China less than a month after their publication here. The film texts have the added advantage that, once arrived in China, they can be passed around from school to school.

That the Chinese have made good use of this oppor-

tunity to keep up with the latest scientific developments is indicated by the fact that sulfaguanadine was used in the Chinese Army for dysentery before its use had become general in America.

GRADUATE COURSE ON INDUSTRIAL HEALTH AND MEDICINE IN WAR TIME AT YALE UNIVERSITY

As announced by Dean Francis G. Blake, the Yale School of Medicine will offer a graduate course designed primarily for physicians of Connecticut on "Industrial Health and Medicine in War Time." The program will consist of twelve afternoons devoted to lectures and seminars by physicians and specialists nationally prominent in the field of industrial medicine. These meetings will be held on Wednesdays from October 7 through December 23. The course is under the joint direction of Dr. William T. Salter, professor of pharmacology; Dr. John R. Paul, professor of preventive medicine, and Dr. C.-E. A. Winslow, chairman of the Department of Public Health. Dr. Winslow said, in commenting on the course:

The growing importance of the field of industrial hygiene and industrial medicine has been evident in the country in general, and particularly in the industrial state of Connecticut. The demands for industrial physicians will increase, and the type of service that they will be asked to perform will be more exacting during the next few years.

In these days, family life is centering more and more about industry. Therefore industrial medicine will soon be required as a new specialty, and the doctor who can help both labor and management in the maintenance of a healthy working force will be more and more important.

The men behind the guns constitute our first line of defense; but they are helpless without a second line—the men and the women who make the guns. The fate of our country depends on both these groups. The men in service are rigorously selected and protected by every device known to medical science. The workers in war industries have often in the past been left to shift for themselves.

Many urgent and complicated problems must be met by industrial physicians in these times. For example, women are replacing them in various types of defense work. What will be the physical result? How far can average women be adapted to fatiguing and trying tasks? Likewise, *defense plants may be subjected to concentrated* attack by raiders or saboteurs. In planning for such possible emergencies the industrial physician must be prepared to play an important part. Furthermore, in order to maintain maximum output of war materials, the general nutrition of workers must be maintained. These are but a few of the intricate questions which the doctor must assist in solving.

Sickness and accidents among industrial workers cause the loss of 234,000,000 man-days of work a year, according to one careful survey. If we assume 300 work days per man a year, this means that on a given day more than 700,000 industrial workers are incapacitated. It is estimated that half of this absenteeism could be eliminated by preventive measures and adequate medical care.

This is why it is so vitally important that industrial physicians should be provided to supervise the health of the workers in our war industries. Industrial medicine *is a complex and exacting specialty requiring special* training and experience.

The lecturers and their topics are as follows:

October 7. Toxicity and Potential Dangers of Aliphatic and Aromatic Hydrocarbons, Dr. W. F. Von Oettingen, U. S. Public Health Service.

October 14. Dusts and Silicosis, Dr. Leroy U. Gardner, Saranac Laboratory.

October 21. Toxicity and Potential Dangers of Metals, Dr. Robert A. Kehoe, University of Cincinnati.

October 28. Toxicity and Potential Dangers of Chlorinated Hydrocarbons, Dr. Alice Hamilton.

The Use of Hazardous Materials in Industry and Methods for Atmospheric Determinations, A. L. Coleman, Connecticut State Department of Health.

November 4. Dermatoses in War Industries, Dr. Louis Schwartz, U. S. Public Health Service.

November 11. Factory Epidemiology, Lieutenant-Colonel A. J. Lanza, M.C., U. S. Army.

Control of Industrial Accidents, Everett W. Martin, Liberty Mutual Insurance Co.

November 18. Nutritional Problems in Industry, Dr. Robert S. Goodhart, Office of Defense Health and Welfare.

Practical Problems of Nutrition, Dr. George R. Cowgill, Yale School of Medicine.

November 25. The Influence of Physical Factors upon Fatigue of the Industrial Worker, Lieutenant-Colonel D. B. Dill, Air Corps, U. S. Army.

Engineering Control of Plant Health Hazards, B. F. Postman, Connecticut State Department of Health.

December 2. Extra-Mural Factors in Industrial Health, Dr. C.-E. A. Winslow, Yale School of Medicine.

Organization of Health Services in Industry, Dr. M. I. Hall, General Motors Corporation.

December 9. New War-Time Problems in Industry, J. J. Bloomfield, U. S. Public Health Service.

Employment of the Physically Handicapped Worker, E. R. Chester, Connecticut State Department of Education.

December 16. Mental Hygiene in Industry, Dr. Lydia Giberson, Metropolitan Life Insurance Company.

Medico-Legal Problems in Industrial Medicine, Dr. Louis Sachs, New Haven, Connecticut State Workmen's Compensation Commission.

December 23. Opportunities and Responsibilities of the Medical Profession in Industry, Dr. Arthur B. Landry, Hartford, Committee on Industrial Health, Connecticut State Medical Society.

Availability of Public Health Services to Industrial Physicians, Dr. A. S. Gray, Connecticut State Department of Health.

REGISTRATION IN THE NATIONAL ROSTER

DR. J. S. NICHOLAS, of Yale University, National Research Council representative on the National Roster of Scientific and Professional Personnel, has sent to SCIENCE further results of its questionnaire, giving registration as of September 2.

	Number mailed	*Number returned*
Agronomy and soil sciences		1,105
Anatomy	835	653
Animal husbandry		719
Bacteriology	3,763	2,243
Biology	80	25
Botany	2,200	1,449
Chemistry	100,741	68,918
Dairy science		1,196
Fish and wildlife research		318
Forestry and range management	5,463	4,147
Genetics	2,084	1,073
Geology	7,599	4,032
Geophysics	4,370	2,057
Horticulture		764
Mathematics	12,092	6,926
Mycology		19
Nutrition	513	301
Pharmacology	354	229
Physics and astronomy	13,712	9,831
Physiology	1,045	694
Plant pathology		909
Psychiatry	1,115	830
Tropical medicine	912	461
Veterinary bacteriology		149
Veterinary science		5,310
Zoology and entomology	7,916	4,639

In the previous month's report on the registration in the National Roster (SCIENCE, 96: 2486, 175), due to the system of main headings employed, the agricultural fields were not listed separately. They are still partly covered by other groups, but this is due to individual choice of the society members in filing their questionnaires. In recircularizations which are now taking place as speedily as possible, it is hoped that each individual will indicate his main field of endeavor and request the technical check list most applicable to his field. Accuracy in personal evaluation is a necessity for the correction of roster figures. The cooperation of scientific men is solicited.

SCIENTIFIC NOTES AND NEWS

CHARLES EDWARD WILSON, president of the General Electric Company, has been named a vice-chairman of the War Production Board. Gerard Swope, president of the General Electric Company from 1922 to 1939, now director and honorary president, will resume the presidency.

THE Caldwell Medal of the American Roentgen Ray Society for distinguished work in cancer research was presented on September 15 at the New York meeting to Dr. Cornelius Packard Rhoads, director of the Memorial Hospital for the Treatment of Cancer in New York City.

THE Borden achievement award for distinguished contributions to poultry science has been given to Vigfus S. Asmundsen, associate professor of poultry husbandry at the University of California. The award, which is for accumulated research over a period of seven years, rather than for a single piece of work, carries with it a gold medal and $1,000. Ordinarily the medal is conferred at the annual meeting of the Poultry Science Association, but since that meeting has been cancelled this year, the presentation has been arranged by Dean C. B. Hutchison, of the College of Agriculture at Davis. A representative of the Borden Milk Company will present the medal, at a time to be set later.

DR. KARL F. MEYER, director of the Hooper Foundation of the University of California, San Francisco, was chosen president-elect at the Seattle meeting of the Western Branch of the American Public Health Association. He succeeds Dr. Donald G. Evans, Seattle, who was installed as president.

DAVID T. POTTINGER, associate director of the Harvard University Press, has been elected an honorary vice-president of the American Institute of Graphic Arts.

OFFICERS of the American Psychological Association have been elected as follows: *President,* John E. Anderson; *Council of Directors,* Sidney L. Pressey, Robert H. Seashore; *Treasurer and Business Manager of Publicity,* Willard L. Valentine; *Nominees for Representatives on the National Research Council,* John E. Anderson, Arthur G. Bills, Hadley Cantril; *Representative on the Social Science Research Council,* Walter S. Hunter.

LIEUTENANT COMMANDER C. M. LOUTTIT, U.S.N.R., was elected president of the American Association for Applied Psychology on September 4 at the sixth annual meeting held in New York City. Dr. Alice I. Bryan, Columbia University, was made executive secretary.

PAUL M. DUNN, who has been since 1935 head of the work in forestry at Utah State College, has been elected dean of the School of Forestry of Oregon State College. He succeeds Acting Dean Earl G. Mason, who has served since the retirement of the

former dean and president, Dr. G. W. Peavy. Dr. Mason will continue his work as professor of forestry.

Dr. Vernon I. Cheadle, assistant professor of botany at Rhode Island State College, has been promoted to a professorship and has been made head of the department. He succeeds Dr. H. W. Browning, who has been made vice-president of the college and dean of the School of Science and Business.

Dr. Thomas D. Dublin, epidemiologist in the New York State Department of Health, has been appointed head of the department of preventive medicine and community health at the Long Island College of Medicine.

Dr. Herbert F. Traut, of Cornell University Medical College, has been appointed professor of gynecology and obstetrics at the University of California Medical College, San Francisco.

Dr. Pablo Morales-Otero, acting director of the School of Tropical Medicine, University of Puerto Rico, has been appointed director. He succeeds Dr. George W. Bachman, who has been director since 1931.

Dr. Aura Edward Severinghaus has been appointed assistant dean of the College of Physicians and Surgeons of Columbia University.

Dr. H. J. Muller, research associate, has been appointed for the duration of the war professor in the department of biology of Amherst College.

Dr. S. Bernard Wortis, associate professor of neurology, has been appointed the first Lucius N. Littauer professor of psychiatry at the New York University College of Medicine and visiting neuropsychiatrist in charge of the Psychiatric Division of Bellevue Hospital. He succeeds Dr. Karl Bowman, who resigned last year. The chair of psychiatry has been named for Lucius N. Littauer, the philanthropist, who established in 1941 a fund of nearly a quarter of a million dollars "for research in psychiatry, neurology and related fields, in order to increase and diffuse knowledge of the biological and other factors which influence thought and conduct; and thereby to prevent and correct abnormal human behavior through clinical and experimental approaches."

James W. Schade, until December, 1941, research director at the B. F. Goodrich Rubber Company, has joined the staff of the University of Akron (Ohio) to give a special lecture course in rubber technology, in cooperation with the Goodrich, Firestone and Goodyear Rubber Companies. The lectures will be especially designed for young men coming into the industry, aiming to give them a broad understanding of the entire rubber production field.

Sir Henry Dale, president of the Royal Society, London, who was recently appointed a member of the governing body of the Lister Institute of Preventive Medicine, has been elected by the board as its chairman.

Dr. Louis B. Flexner, of the department of anatomy of the Johns Hopkins University School of Medicine, has leave of absence to enable him to serve as aide to the committee on aviation medicine of the National Research Council.

Dr. Dorothy Bird Nyswander, of the New York City Department of Health, has been named regional supervisor of War Public Service Projects of the Federal Works Agency.

Dr. Henry W. Cave, who has been serving as state chairman for physicians in New York of the Procurement and Assignment Service, has been appointed chairman of the Second Corps Area, which embraces the states of New York, New Jersey and Delaware. Dr. Joe R. Clemmons will succeed Dr. Cave as the state chairman for physicians in New York. Dr. Donald S. Childs is vice-chairman for physicians in the upstate area.

Dr. Loyal Davis, head of the surgical department of Northwestern University Medical School, Chicago, and editor of *Surgery, Gynecology and Obstetrics*, has been commissioned a lieutenant colonel in the U. S. Army Medical Department and assigned to duty as consultant in neurosurgery in the Surgeon General's Office, Washington, D. C.

A. Turner Wells, secretary and director of the American Optical Company, has been commissioned a captain in the Medical Department, Service of Supplies, and is attached to the Surgeon General's office in Washington. He assisted in designing the mobile optical unit recently accepted by the Government. Through the unit, men in the armed forces will be able to obtain optical repairs near the front.

Dr. Raymund L. Zwemer, of the department of anatomy of the College of Physicians and Surgeons, Columbia University, has recently returned from three months spent in research and teaching at the Institute of Endocrinology, Montevideo, Uruguay. He was sent by the Committee for Inter-American Artistic and Intellectual Relations of the Office of the coordinator for Inter-American Affairs at the request of Dr. Mussio-Fournier, Uruguayan Minister of Public Health. On the return trip, Dr. Zwemer visited various universities and gave lectures in Argentina, Paraguay and Brazil. One of the lectures in Rio de Janeiro was given before five hundred military surgeons at the Ministry of War, just after war was declared by Brazil on the Axis.

Dr. W. C. Lowdermilk, assistant chief of the Soil Conservation Service of the U. S. Department of

Agriculture, according to Science Service, has been placed at the head of a scientific mission at the request of the Chinese Government. Dr. T. Dykstra, plant breeder in corn and potatoes, is accompanying Dr. Lowdermilk, and later an animal breeder and hydraulic engineers will join them in Chungking. The need for food in China has been increased by the 60,000,000 refugees who fled inland as a result of the Japanese invasion. Cultivation was pushed up the slopes of the hills and mountains. Crops such as potatoes and corn were more generally grown. Dr. Lowdermilk and his colleagues will cooperate in setting up a soil conservation service which will be a permanent organization for the purpose of assuring ample food production in coming years. The group will work closely with Dr. D. Y. Lin, of the Chinese Ministry of Agriculture in Chungking.

THE Research Council on Problems of Alcohol, an associated society of the American Association for the Advancement of Science, will meet at one o'clock on Monday, September 28, in the Commodore Hotel, New York.

THE annual meeting of the New York State Geographical Association, which had been planned for Oswego on November 7, has been cancelled.

DR. ROBERT H. SEASHORE, chairman of the Public Relations Committee of the American Psychological Association, writes: "It may be of interest to other societies to note that due to the increase of defense transportation, the regular five-day meetings of the association scheduled for the same week at Harvard University were cancelled and a skeleton one-day business meeting was held in New York City in order to conserve transportation facilities. Since the reduced meeting had an attendance of only ten per cent., as compared with normal meetings, it can be seen that there was a very great saving in transportation. A similar skeleton meeting to administer the business officers of the association will be held in Chicago during the first week in September of next year unless other emergencies interfere. The association is continuing its Office of Psychological Personnel under the auspices of the National Research Council in order to facilitate the placement of psychologists in various military and other governmental offices."

IT is reported that at a special meeting in Chicago on September 17, the American Medical Association decided to cancel its next annual meeting. In place of this meeting, which is usually attended by from 6,000 to 10,000 physicians, the house of delegates, the board of trustees, the scientific councils and officers will meet in Chicago next June to deal with the essential business of the association and the war-time problems of the medical profession. Cancellation of the meeting, which had been scheduled for San Francisco next June, marks the first time since the Civil War that the association has postponed one of its annual sessions. The trustees, it is reported, also took into account the strain that such a large delegation in San Francisco would place on war-burdened transportation facilities.

THE council of the Royal Horticultural Society reports that for its general senior examination held in prisoner of war camps in Germany it has received the papers from nine candidates, and that five of these candidates have passed the examination.

DISCUSSION

THE NEW YORK MATHEMATICS TABLES PROJECT

MATHEMATICIANS and many other scientific workers can become enthusiastic over certain expenditures by the Government's Work Projects Administration (WPA) which have led to the publication and calculation of many important mathematical tables, sold very cheaply when published. The large bound volume of "Natural Sines and Cosines to Eight Decimal Places," for every second of arc, recently issued as Special Publication No. 231 of the U. S. Coast and Geodetic Survey ($1.75), was prepared in 1941–42 as a WPA project at Philadelphia, under the sponsorship of the Survey. The personnel of this Philadelphia group was also mainly responsible for the 8 large volumes of tables ($2.25 each) in Hydrographic Office, Publication No. 214, 1941, "Tables of Computed Altitude and Azimuth, Latitudes 0° to 79° Inclusive." Their other work was much less mathematical. But during the past four and one-half years the Mathematical Tables Project of the WPA in New York City has achieved an extraordinary body of calculation and publication. A somewhat detailed account of this would seem to be timely and likely to interest many people. It is hoped that such publicity may contribute to action serving to make the project's activities still more potent. Further reference to such action is made towards the close of this article.

The actual organization of the New York Project began in January, 1938, under the sponsorship of Dr. Lyman J. Briggs, director of the U. S. Bureau of Standards, who determines the Project's policies and activities, and oversees the distribution of its publications. It is indeed fortunate that representations to

the government on behalf of the Project should be made by a man of such eminence, fully conversant with the scientific implications of all that the Project undertakes. The technical supervision of the Project was placed in the hands of Dr. Arnold N. Lowan, who has not only served the Project with notable ability, but has also in various ways assisted many inquiring scientists with very useful information.

Those setting up the Project were given detailed instructions as to the persons whom they might employ. It was not long before a large corps of computers and computing machines had been assembled, and the demands for new tables were constantly increasing.

In that extraordinary laboratory at 70 Columbus Avenue in New York City, there are now 250 computers working in two shifts from 9:00 o'clock A.M. to 5:00 P.M., and from 5:00 P.M. till midnight, on five days of the week. The two shifts were necessary in order fully to utilize the following 150 machines: A Burroughs Comptometer, 27 Friden Calculators (10 banks), 8 Marchant Calculators (10 banks), 6 Monroe Calculators (8 banks), 59 Monroe Calculators (10 banks), 4 Remington Adding Machines and 45 Sunstrand Adding Machines. Until recently the following 19 machines of the International Business Machines Corporation were also in use; 1 type 405 Alphabetic Accounting Machine; 5 type 601 Automatic Multiplying Machines; 2 type 077 Collators; 3 type 80 Horizontal Sorters; 6 type 15 Motor Drive Punch Machines; 1 type 5B Automatic Reproducing Punch and 1 type 513 Reproducing Summary Punch. Surely never before has such an extensive scientific computing laboratory been established. It is kept working to fullest capacity by confidential demands of the Army and Navy, and by many approved requests of scientists. Brief indications may be given of *A*. Tables already published; *B*. Tables in process of reproduction; *C*. Tables for which manuscripts are completed; *D*. Tables for which computations are completed; and *E*. Tables for which computations are in progress.

A. The following 12 large volumes ($8\frac{1}{2}$ x 11 ins.), strongly bound in buckram, are sold at two dollars each:

1. Tables of the Exponential Function e^x, 1939, 535 p.
2. Tables of Sines and Cosines for Radian Arguments, 1940, 275 p.
3. Tables of Circular and Hyperbolic Sines and Cosines for Radian Arguments, 1940, 405 p.

4–5. Tables of Probability Functions $\frac{2}{\sqrt{\pi}}e^{-x^2}$, $\frac{1}{\sqrt{2\pi}}e^{-x^2/2}$, $\frac{2}{\sqrt{\pi}}\int_0^x e^{-t^2}dt$, $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^x e^{-t^2/2}dt$, 2v., 1941–42, 696 p.

6–8. Tables of Sine, Cosine, and Exponential Integrals, 1940–42, 3v., 673 p.

9–12. Table of Natural Logarithms, 4v., 1941–42, 2009 p.

There are also (among others)

13. Table of the first ten Powers of Integers from 1 to 1000, 1939, 80 p. ($8\frac{1}{2} \times 13\frac{1}{2}$ ins.)

and the important

14. Table of Lagrangean Interpolation Coefficients, prepared for the Ordnance Department in June, 1941, 50 p. ($8 \times 10\frac{1}{2}$ ins.), but only recently released for more general distribution by Dr. Briggs.

B. Among tables in process of reproduction are:

1. Table of the Electronic Functions $G = 1/(1-\beta^2)^{\frac{1}{2}}$, $v = (m_0c^2/e)(G-1)$ and $H\rho = [(m_0c)/e](B_G)$;
2. Table of Arctan x;
3. Table of the Bessel Functions $J_0(z)$ and $J_1(z)$ for Complex Arguments $z = \rho e^{i\phi}$;
4. Miscellaneous Hydraulic Tables.

C. Manuscripts have been completed for the following tables:

1. Table of the Associated Legendre Functions $P_n^m(x)$ and $Q_n^m(x)$, for arguments x and ix;
2. Table of fractional powers a^x and x^a;
3. Table of $\int_0^x J_0(t)dt$ and $\int_0^x Y_0(t)dt$;
4. Tables of Tan x, Tanh x, Cot x and Coth x $[0(.0001)2]$;
5. Tables of the Definite Integrals

$$A(k, n) = \int_0^1 x^k \sin(n\pi x)dx, \; B(k,n) = \int_0^1 x^k \cos(n\pi x)dx, \; k = 0, 1, 2 \cdots; \; n = 1, 2 \cdots, 100;$$

D. There are also three important tables for which computations are completed:

1. Table of the Bessel Functions $J_\nu(x)$ and $I_\nu(x)$;
2. Table of $Q_n(x) = \sqrt{\frac{\pi}{2x}}\, J_{n+\frac{1}{2}}(x)$;
3. Table of Reciprocals of the integers from 100,000 to 200,000.

E. Then there are the following six equally important tables for which computations are in progress:

1. Table of Bessel Functions $Y_0(z)$ and $Y_1(z)$ for complex arguments;
2. Tables of Lagrangean Interpolants, Orders three to eleven;
3. Tables of the Complete Elliptic Integrals K of the First Kind, the Nome $q = \exp(-\pi K'/K)$, and the Elliptic Functions am u, sn u, cn u, dn u, for real and imaginary arguments;
4. Tables of the Chebyshev Polynomials $C_n(x)$ and $S_n(x)$, $n = 1, 2, \cdots, 12$;
5. Table of the first ten Powers of the Reciprocals of the Integers from 1 to 1000;
6. Table of Inverse Circular and Hyperbolic Functions other than arctan x (see B.2).

Scientists must regard the calculation of even such a body of important tables as an extraordinarily impressive achievement, for the time that the Project has been in existence. But appreciably more has been done than is here suggested, since no listing of con-

fidential tables for the Army and Navy is permitted. Furthermore, the preparation of all such tables was begun by Dr. Briggs after having in consultation with many experts verified their great value in pursuits of scientific research. The endless requirements of the war effort have only intensified the demand for these and for many other tables. Yet what do we find in connection with the present organization of the Project? It may be years before these 12 completed tables listed in B, C and D are published.

Surely, then, there is here vital need for action, to the end that means be sought for the rapid publication, not only of all the above-mentioned tables, but also of all later tables completed by the Project. There must be many mathematicians and mathematical physicists, who would be willing to join with me in most earnestly commending this matter to the attention of Dr. Briggs.

RAYMOND CLARE ARCHIBALD
BROWN UNIVERSITY,
August, 1942.

STANDARDIZED PLANT NAMES

THE second edition of this work has recently appeared and has been given several brief favorable reviews by individuals who apparently have not gone over it critically from the botanical standpoint. Originally prepared for standardizing Latin and common names for nurserymen and horticulturists the Latin names printed in bold face in the first edition were sometimes compromise names that followed no recognized botanical code, but were followed by the code name in italics, lest too many changes from nursery use would not be acceptable. The result was that these names were not acceptable to botanists and the principal author did not use them in his official publications. The Latin names in the new edition conform, with but very few errors, to the now generally recognized International Botanical Code and under any code occasional changes in names will occur as types are studied and botanists and horticulturists will always have differences of opinion as to the limits of species and genera.

Nurserymen had reason to believe that at least the common names in the first edition would become fairly permanent, yet the present authors have indulged in changes of many common names that would compare well with the vagaries of the most extreme taxonomists and produced many caconyms that will be acceptable neither to botanists nor horticulturists. Common names are fixed by local usage, though not always consistently, and the best of the common names recognized by the standard manuals of botany will continue to be used in future editions and by the far greater number of manual users.

While it has been impossible to make a complete list of exceptions they mostly fall into two groups, *viz.*: two-word combinations of illogical common names and two-word combinations of a common and a Latin name that are exceedingly offensive to most botanists and other users of plant names. Thus far over 100 such names have been discovered in the new edition and additions are turning up frequently. A few examples will suffice.

Group I

Page	Edition I.	Page	Edition II.
19	Dragonroot	22	Dragonroot Jackinthepulpit
158	Wintergreen	271	Checkerberry Wintergreen
267	Common toadflax	301	Butter-and-eggs Toadflax
285	Muskplant	301	Muskplant Monkeyflower
388	Kudzu-bean	505	Thunberg Kudzubean

Group II

Page	Edition I.	Page	Edition II.
60	Nickernut	78	Nickernut Caesalpinia
91	Leatherflower	131	Leatherflower Clematis
185	Farewell-to-spring	276	Farewell-to-spring Godetia
255	Mountain-laurel	319	Mountainlaurel Kalmia
283	Cucumber-root	382	Cucumberroot Medeola

Other long-accepted common names are changed in one word form. Faunlily is applied to the whole genus *Erythronium*, though Troutlily was previously used. It is illogical to apply the prefix Fawn to the species that are white and purple. The western white species is usually called Glacier or Avalanche lily. *Trillium grandiflorum*, commonly called large-flowered Trillium, is erroneously called Snow Trillium, as in the first edition. *Trillium niveum* (niveum meaning snow) is correctly the Snow Trillium. California poppy is changed to Goldpoppy. Bluebonnet is applied to *Lupinus texensis* and Texas lupine to *Lupinus subcarnosus*. These common names should be reversed, as Bluebonnet is officially applied to *Lupinus subcarnosus* in its legal designation as the state flower, but the lay element does not distinguish the species and applies Bluebonnet to both, though perhaps *L. texensis* is the more abundant of the two. Oregon Hollygrape is changed back to Oregongrape.

The use of hyphens is largely, though often illogically, eliminated, but Butter-and-eggs and Farewell-to-spring would also suggest the preferable use of Jack-in-the-pulpit instead of Jackinthepulpit.

The District of Columbia floral emblem, American Beauty Rose, adopted by the Commissioners in 1925, is omitted on page 596 and the dates of official designation of the floral emblem of 15 states are omitted.

A summary of all the items listed shows that of its 675 pages, 73 pages or about 10.8 per cent. have at least 151 omissions or items to which exception will be taken by most botanists, and these do not begin to represent all the additional exceptions found or likely to be found by other botanists. Forty-four of the pages have only one item each, 11–2, 7–3, 3–4, 2–5,

1–7, 1–12 and 1 page 18 items. However, the 151 items listed constitute only 1 in every 596 of the about 90,000 names in the book, not including the cross references.

It is hoped that eventually a complete list of the generally approved changes and few errors and omissions can be made available to those interested.

Standardized Plant Names, second edition, edited by Harlan P. Kelsey and William A. Dayton, Harrisburg, Pa., J. Horace McFarland Co., 1942. Price, $10.50.

P. L. Ricker
The Wild Flower Preservation Society

STUDENTS' LECTURE NOTES

Ninety-nine per cent. of my students in physiology courses given in Europe, China and in Chicago have been writing down the lectures so arduously that they did not have much opportunity either to think or to grasp the significance and relations of the subject. Very few of the students have had the time to go over the lecture notes at home and to correct them and make additions. During my own studies I have found it more profitable to listen intently to the lecturer, to take a few notes about the subjects discussed and to work out the lectures at home. Or, in the case of lecturers who use books, to find out the book and read the chapter at home. I have found very few students who could not remember lectures without having written them down in detail. I feel that the student who tries to write the lecture in the classroom loses more than he can gain, because by the writing he suppresses his critical thinking, the establishment of relationships between different matters and, worst of all, gives himself no training for remembering and associating the spoken word.

I have, therefore, for a number of years adopted the following system which has been successful enough to be made known for the trial and use in other institutions: One student or two, according to the size of the class, is asked to take lecture notes and to elaborate them at home into a well-written and well-correlated paper. The rest of the class is asked not to take notes, but to listen to the lecture critically and to discuss the subject or to ask questions during the last five to ten minutes of the lecture period. The reports of the students are then corrected and amplified by myself, and the pertinent literature is added. The secretary of the class receives this copy and has mimeographic copies made by the secretary of the department. The total cost to the student of these copies for a course of one quarter, two lectures a week, is approximately $1.40. The students have welcomed this method and have made good use of it, as I have been told by a great number of them. They feel that they learn more when they do not write constantly, and they are apparently under less nervous and physical strain than when they would have to watch for every word and sentence.

The reports handed in by the students are used as term papers and are corrected, the final grade of the student depending on the quality of these papers and his understanding and knowledge shown during the discussions at the end of each lecture. In a large class, each student will submit only one paper in a quarter, while in a smaller class he may have to submit two or three papers. If the one paper of a student of a larger class is not satisfactory, he is asked to submit another one. I have found this way of grading students as good as that which is achieved by a final oral or written examination at the end of the quarter. The students have the added advantage that at the end of a quarter they own the corrected and rounded out lecture notes, with the most important references from the literature for future reference, and the lecturer himself has the advantage of having his course worked out and organized so that he can use it again with the addition of recent advances or with slight reorganizations.

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Department of Physiology
University of Chicago

SCIENTIFIC BOOKS

RECENT MEDICAL BIOGRAPHIES AND AUTOBIOGRAPHIES

Four Treatises of Theophrastus von Hohenheim called Paracelsus. Translated from the original German, with Introductory Essays by C. Lillian Temkin, George Rosen, Gregory Zilboorg, Henry E. Sigerist. Edited with a Preface by Henry E. Sigerist. Baltimore: The Johns Hopkins Press. xii + 256 pp., with frontispiece. 1941. $3.75.

Torch and Crucible: The Life and Death of Antoine Lavoisier. By Sidney J. French. ix + 285 pp. Princeton University Press. 1941. $3.50.

Dr. Bard of Hyde Park: The Famous Physician of Revolutionary Times. The Man Who Saved Washington's Life. By John Brett Langstaff. Introduction by Nicholas Murray Butler. 365 pp., with frontispiece, and 11 illustrations. New York: E. P. Dutton and Company. 1942. $3.75.

Death Loses A Pair of Wings: The Epic of William Gorgas and The Conquest of Yellow Fever. By Robin Lampson. xii + 518 pp. New York: Charles Scribner's Sons. 1939. $3.00.

William Henry Welch and The Heroic Age of American Medicine. By Simon Flexner and James Thomas

FLEXNER. x + 539 pp., with frontispiece and 25 illustrations. New York: The Viking Press. 1941. $3.75.

The Doctors Mayo. By HELEN CLAPESATTLE, with a foreword by Guy Stanton Ford, President of the University of Minnesota. xiv + 822 pp., with 65 illustrations. Minneapolis: The University of Minnesota Press. 1941. $3.75.

A Surgeon's Life: The Autobiography of J. M. T. Finney. xiv + 396 pp., with frontispiece. New York: G. P. Putnam's Sons. 1940. $3.00.

A Yankee Doctor in Paradise. By S. M. LAMBERT, M.D. x + 393 pp., with frontispiece. Boston: Little, Brown and Company. 1941. $3.00.

The Man Who Lived for Tomorrow: A Biography of William Hallock Park, M.D. By WADE W. OLIVER. 507 pp., with frontispiece. New York: E. P. Dutton and Company, Inc. 1941. $3.75.

Time and the Physician: The Autobiography of Lewellys F. Barker. viii + 350 pp., with frontispiece and 6 illustrations. New York: G. P. Putnam's Sons. 1942. $3.50.

L. Emmett Holt: Pioneer of a Children's Century. By R. L. DUFFUS and L. EMMETT HOLT, JR. Foreword by Edwards A. Peck, M.D. xiv + 295 pp., with frontispiece. New York: D. Appleton-Century Company, Inc. 1940. $3.00.

Hugh Young: A Surgeon's Autobiography. xiii + 554 pp., with frontispiece, 103 anatomical drawings, and other illustrations. New York: Harcourt, Brace and Company. 1940. $5.00.

As I Remember Him: The Biography of R. S. By HANS ZINSSER. ix + 443 pp. Boston: Little, Brown and Company. 1940. $2.75.

EXCEPT for subjects dead for several centuries, biographies are usually inspired apologies. In the case of autobiographies, this apologetic tendency may become almost psychiatric, at least in the case of physicians. The anguished human conscience of the egocentric crusader, such as Hugh Young, appears in his: "There is still so much to do, and so much to live for." The apology of the shy introverted humanistic scientist is stated by Hans Zinsser, speaking of himself: "R. S. was really quite an ordinary person about whom it was hardly worthwhile to write a book. . . . At the time of his death he was as thoroughly bewildered as any thoughtful individual of our time is bound to be."

None of the biographies here noticed have the detailed delineation (or dullness) of such a recent classic as Harvey Cushing's "Life of Sir William Osler" (2 volumes, Oxford, 1925). The autobiographies are written too self-consciously to be honest. These biographies and autobiographies, therefore, are slightly disappointing, like all such efforts must be, to those who know the subjects. They are all, however, interesting and significant in showing the power of current American medical genius.

Not accidentally were the books on Lavoisier and Paracelsus included among these characteristic volumes. Both men were intellectual heretics in their time. Both exemplify that independent tendency of American medicine, which, repudiating the past which once inspired it, points the way to new practical achievement.

It may seem peculiar to consider a series of annotated translations of the writings of Paracelsus as a "biography." After four centuries, however, a man appears more clearly from his own words than from any account a formal biography might give. The common clay of humanity lies naked and unashamed in his "Reply to Certain Calumniations of His Enemies." His environmental conditioning is apparent in his "Book on Nymphs, Sylphs, Pygmies, Salamanders and on the Other Spirits." His skill in clinical observation and prescription and his courage in probing for a rational understanding of obscure abnormalities is apparent in his writing: "On the Minor Sickness and Other Diseases and The Diseases That Deprive Man of His Reason, Such as St. Vitus Dance, Falling Sickness, Melancholy, and Insanity, and Their Correct Treatment." In publishing this book, Professor Sigerist's wish is accomplished—to revive "the personality of an honest man who was a great physician and a staunch fighter for what he considered the truth. It is so easy to be orthodox and to reap honors by repeating what people expect and wish to hear. Progress, however, is achieved through a clash of ideals, and heretics like Paracelsus are a ferment without which there would be no life."

While Professor French's account of Lavoisier necessarily relies on Grimaux's standard biography, it breaks new ground in appraising the scientific achievements of Lavoisier. While Lavoisier's scientific dependence on Priestley and Cavendish is carefully described, he is depicted as the leading scientific organizer for his century, not only in chemistry, but also in physiology, biology and sociology. An interesting detail is the discussion of the relationship between Lavoisier and the du Ponts.

Although European medicine was firmly established in the sixteenth century by the Spanish in Mexico, and in the seventeenth century by the French in Canada, English medicine did not develop until the eighteenth century in the American colonies. Philadelphia and New York vied with each other in the quality of their medical service, and in the establishment of hospitals and training centers. Most of the early leaders of American medicine studied in Edinburgh and London. After returning from these centers, Samuel Bard (1742–1821) promoted the New York Medical School, which is now the College of Physicians and Surgeons of Columbia University, assisted in the founding of the famous New York

Hospital, developed Hyde Park, and with his pupil David Hosack (1769–1835) established the Elgin Botanical Gardens, where Rockefeller Center now stands. Bard and Hosack were notable examples of the public-spirited American physicians of the late eighteenth and early nineteenth centuries, and their influence did much to shape the practical course of subsequent American medicine.

Robin Lampson has attempted something new in biography. Although this remarkable "novel in cadence" was published three years ago, a review of it is still pertinent, since the work seems to be so little appreciated by scientists. It is an extremely accurate analysis of the achievement of William Gorgas in applying available scientific knowledge to the public health control of yellow fever. Lampson's effort is an extraordinary union of sound science with high artistic skill. Since many scientists fail to realize the intellectual aspects of serious artistic effort, and particularly since most scientists are not interested in literary innovations, this remarkable book has been neglected by the very ones who might profit most from it. The story is told only to 1903, but an appended chronology carries Gorgas's life to his death in 1920. The care with which Lampson compiled his material is indicated by his extensive acknowledgments, particularly to important and frequently forgotten literary sources.

Perhaps the most important book of the biographies here surveyed is Simon and James Flexners's "William Henry Welch." The sub-title, "The Heroic Age of American Medicine," implies a rather peculiar judgment. This fine achievement of the Flexners is a quite successful attempt to combine a definitive biography, which by itself is apt to be dull, with a popularization and interpretation, which alone is apt to be exaggerated for effect. Copious notes indicate the vast material used by the Flexners in preparing this very readable account of their hero. Mostly, of course, it is eulogistic. This is appropriate, since Welch's scientific achievements in bacteriology and pathology are outstanding, and his successful applications of his knowledge to social problems involving public acceptance of public health measures are extremely significant. Those familiar with the development of American medicine during the past half-century have suspected much of the wise behind-the-scenes manipulations of Welch. Unfortunately, hero-worship tends to minimize obvious faults. Welch himself would have been among the first to acknowledge them, because he was genuinely honest and human. A serious error in judgment for which Welch was responsible, for example, was the unfortunate division of medical schools such as those at Harvard, Washington University at St. Louis and Johns Hopkins at Baltimore, from the main university campus. On the other hand, we have by no means approached Welch's high scientific and humane idealism, as witness the contrast between our present anonymous censorial control of scientific reporting and Welch's influence in preventing such conditions in 1917. We need Welch's wise counsel. Fortunately it is available in the many examples described so well by the Flexners.

The practical character of American medicine is remarkably exemplified by William J. (1861–1939) and Charles Mayo (1865–1939). Following faithfully in the pioneer footsteps of their physician father, the famous brothers made their clinic in Rochester, Minnesota, a world center for surgical achievement and medical research and training. Their amazingly active career and their extraordinary success is detailed with skill in this well-illustrated and thoroughly documented volume. The solid achievement of the Mayos remains, without inviting thus far the "debunking" that often follows excessive eulogistic publicity.

The recent untimely death of Dr. J. M. T. Finney, for so long professor of surgery at Johns Hopkins, brings his autobiography into bold relief. Dr. Finney was born in 1863 on a Mississippi plantation, was educated at Princeton and Harvard Medical School, and promptly became one of the outstanding Hopkins surgeons. He describes clearly his important services during the last war, and gives particularly entertaining accounts of his professional colleagues. Remarkable was his refusal of the presidency of Princeton.

One of the most interesting of recent medical autobiographies is Dr. Lambert's account of his long service with the International Health Board in New Guinea, the Solomon Islands, Fiji, and all the fascinating South Pacific potential paradises. The book is brilliantly written and contains an extraordinary amount of general scientific information bearing on anthropology, sociology, geography and geology, preventive medicine, chemotherapy and zoology. There are interesting accounts of the many scientific expeditions which have studied in the South Seas during the past quarter of a century. Impressive is the practical achievement in tremendous reduction in preventable diseases and in the death-rate through the South Pacific area as a result of the application of modern scientific information. Significant are Dr. Lambert's many wise observations on the character of the people. The book should be carefully studied, particularly at this time by all who are interested in the problem we are facing in the Pacific.

Like so many other leaders of American medicine, William H. Park (1863–1938) devoted his career to the applications of bacteriology, immunology and epidemiology, to the prevention of disease generally,

and to the promotion of public health. Park's great achievement was the establishment of the highly efficient public health service for the world's greatest city. The details of his career show why he was cited as "the perfect type of a scientist in the service of the state."

Among the many brilliant leaders who made the Johns Hopkins Medical School so great is Lewellys F. Barker, a Canadian Quaker, who studied in Toronto and Europe, served in the Philippines and in India, and succeeded Osler as head of the Department of Medicine at Hopkins. Later he gave up his full-time university work to engage more in practice and public work of a broad social nature.

The development of pediatrics has been one of the outstanding achievements of modern medicine. An American pioneer and influential leader in this was Luther Emmett Holt (1855-1924). Most of Holt's career was spent in New York City, although he traveled extensively and participated in professional work in Europe and China, after World War I. Like most leaders in American medicine, Holt was a prodigious writer, and his texts relating to his specialty have been standard in medical literature for years.

Hugh Hampton Young's autobiography is vigorous and entertaining. It paints an astonishing picture of contrast between serious citizenry, merry-making buffoonery and careful meticulous technique in surgery. The volume is unusual in containing a considerable amount of technical material relating particularly to the study of urology, which Dr. Young has been so instrumental in promoting. There are intriguing chapters on World War I medicine, Diamond Jim Brady, excursions of all sorts to all parts of the world, and a remarkable series of pen pictures of his many brilliant associates at Hopkins. It also contains the story of mercurochrome, but not quite complete.

Hans Zinsser's remarkable autobiography is a brave and brilliant apology for modern culture. His religious and romantic impressions are sensitive poetry; his anecdotes are delightful; his descriptions of his professional work, particularly in Serbia, Russia, Tunis and the Orient, emphasize the political difficulties of applying modern knowledge to human welfare, and through it all his philosophical confusion resolves into a long-range optimism which even impending death can not dispel.

Significant as a group is this baker's dozen of recent biographies and autobiographies relating to medical leaders. They indicate the dependence of American medical science on its European sources—a dependence melting now into a common pool of scientific achievement with our English colleagues. Whereas American medicine stems from sturdy Scotch and English roots, it has been abundantly grafted with French and German buddings. Many of these are now being trimmed away. It remains to be seen whether the stock will be able to carry the heavy potentialities of Russian or Chinese or Latin-American medical ideas which are certain to flourish among us if given a chance.

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SPECIAL ARTICLES

HEPARIN AND THE ANTITHROMBIC ACTIVITY OF PLASMA[1]

THE antithrombin of plasma destroys thrombin almost as rapidly as the latter is formed. Eventually, the serum, expressed from the clot, is found to contain merely traces of prothrombin and thrombin.

On adding heparin to plasma, the antithrombic activity is known to be "increased." We shall show, however, that heparin does not increase the total capacity of plasma to destroy thrombin; it merely increases the speed with which it does so. The heparin thus appears to behave merely as a catalyst in the destruction of thrombin.

Fig. 1 illustrates the relationships which were found. Into each of 4 tubes were placed 3,880 units of purified thrombin. To one (A) was added heparin alone, to another (B) was added plasma, to a third (C) and a fourth (D) were added both heparin and plasma. All tubes were made up to constant volume and were then allowed to stand for an hour. During that time the thrombin concentration was repeatedly measured. The heparin alone (Curve A) had no effect. The most striking change was shown by the tube (D), containing plasma, together with 0.5 Toronto units of heparin. Here the thrombin titer fell precipitously to the 1,500-unit level within a minute. It then remained at that level throughout the course of the experiment. With only 0.1 unit of heparin (curve C) the thrombin titer also fell to the 1,500-unit level, but 15 minutes were required instead of one.

From these experiments it is evident that the amount of co-factor determines the amount of thrombin destroyed; the amount of heparin determines the *speed* of destruction.

[1] This work was aided by a grant from the John and Mary R. Markle Foundation. Funds for a technical assistant were also supplied by the Graduate College, State University of Iowa.

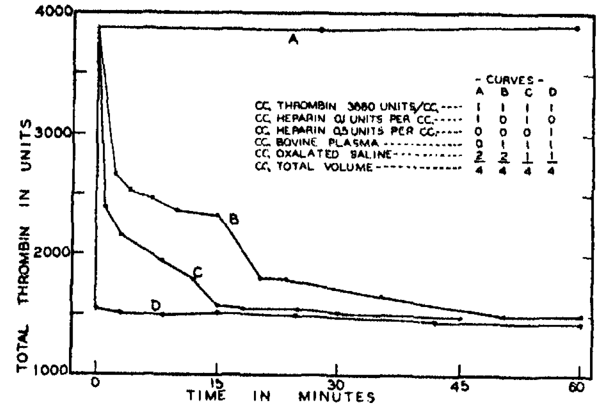

FIG. 1. The thrombin and the heparin were dissolved in oxalated saline (0.075 per cent. $K_2C_2O_4$ + 0.80 per cent. NaCl). Oxalated bovine plasma was obtained from a mixture of 7 parts blood and 1 part 1.85 per cent. $K_2C_2O_4$. The thrombin unit is the amount required to clot 1 cc of purified fibrinogen solution, containing calcium and acacia, in 15 seconds. In these experiments, calcium was omitted in order to avoid forming thrombin from the prothrombin present in the oxalated plasma. Under these conditions (*Am. Jour. Physiol.*—in press), thrombin is one third less efficient; the thrombin titers were therefore multiplied by the factor, 1.5, and the results were then plotted in terms of standard units.

In light of these findings, it is of great interest that plasma alone, without a supplement of heparin, also caused the thrombin titer to fall to the 1,500-unit level (tube B). The fall occurred quite slowly, however—almost an hour was required. It is known that plasma contains small amounts of heparin, and this heparin may be an essential catalyst, without which the reaction can not occur in finite time. It will be necessary to isolate the co-factor in order to determine whether, in the absence of heparin, it possesses any detectable antithrombic activity. It may well be that it does not.

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THE ULTRAVIOLET SPECTROGRAPHIC EXAMINATION OF THE FAT FRACTION OF MOUSE MILK AND MAMMARY GLANDS[1]

THE presence of a mammary tumor-producing substance in the milk of high tumor strain mice has been adequately demonstrated by Bittner,[2] Andervont,[3] DeOme.[4] It is known to be present also in the blood and certain tissues of high tumor strain females.[5,6] If this factor is similar to the estrogens or known synthetic carcinogenic hydrocarbons, it should be demonstrable by a comparison of the ultraviolet absorption spectra of the fat fractions of the milk and the mammary glands of high and low tumor strain mice. Milk and non-tumorous mammary glands from lactating high tumor strains, A, C3H and dba and from the low tumor strain C57Black were studied.

Milk was obtained by means of a miniature milking machine. Only mammary glands engorged with milk were used. Freshly excised mammary glands were plunged into liquid air and macerated with CO_2 as described by Strait and Aird.[7] The macerate was extracted by a solvent-separation procedure involving the use of acetone, ether, alcohol and isooctane. Alcohol soluble and insoluble fractions were studied independently. Preliminary control experiments indicated that extreme care is necessary in the use and purification of solvents if spurious results are to be avoided. The extraction procedure permitted study of the ultraviolet region down to 2300 Å, a range sufficient to include compounds of the type expected. Five samples of milk from A and C57Black mice averaging 3.26 g and eleven samples of mammary glands averaging 3.62 g were used. The absorption spectra of the extracts in spectroscopically pure isooctane were photographed in the ultraviolet with a Hilger medium quartz spectrograph. The extraction procedure is known to recover 1, 2, 5, 6-dibenzanthracene and the estrogens triphenylethylene and oestradiol.

A comparison of the ultraviolet absorption spectra of milk and mammary glands of high and low tumor strain mice showed no significant differences. These results would indicate that (1) the milk-borne factor either is not carried in the fat fraction or, if it is (2) it is not spectrographically similar to the carcinogenic hydrocarbons or estrogens, or (3) it is present in quantities too small to be detected spectrographically. Triphenylethylene may be detected in concentrations of 0.025 milligrams per gram, the naturally occurring estrogens in somewhat higher concentrations, and the carcinogenic hydrocarbons in lower concentrations.

Since the initiation of these experiments, recently published ultracentrifugation data[8] have indicated also that the active agent is primarily in the non-fat fraction. Ultrafiltration experiments by one of us on

[1] This work was in part supported by a grant in aid from the Blanche and Frank Wolf Foundation. The authors wish to express their appreciation to Dr. I. H. Perry for her valuable counsel.
[2] J. J. Bittner, *Jour. Nat. Cancer Inst.*, 1: 155, 1940.
[3] H. B. Andervont, *Jour. Nat. Cancer Inst.*, 1: 147, 1940.
[4] K. B. DeOme, *Am. Jour. Cancer*, 40: 231, 1940.
[5] J. J. Bittner, *Pub. Health Rep.*, 54: 1827, 1939.
[6] G. W. Woolley, L. W. Law, C. C. Little, *Cancer Res.*, 1: 955, 1941.
[7] L. A. Strait, R. B. Aird, S. Weiss, *Jour. Pharm. Exp. Therap.*, 73: 363, 1941.
[8] M. B. Visscher, R. G. Green, J. J. Bittner, *Proc. Soc. Exp. Biol. and Med.*, 49: 94, 1942.

the non-fat portions of milk and mammary tissues are now in progress.

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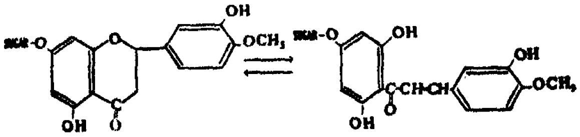
THE ISOLATION OF A NEW OXIDATION-REDUCTION ENZYME FROM LEMON PEEL (VITAMIN P)[1]

SZENT-GYÖRGYI and collaborators in 1936[2] postulated the existence in lemon peel of a new vitamin, designated the permeability vitamin or P, concerned with the regulation of capillary permeability and fragility. Since then much experimental and clinical work has been carried out with crude preparations indicating the presence of factors influencing the capillary state, the blood pressure and related phenomena. It was the purpose of the present work to isolate in pure form the capillary or vitamin factor.

Vitamin P was believed by Szent-Györgyi[3] to be citrin, a mixture of the flavanone glycosides, hesperidin and eriodictin. We initially prepared citrin by a method similar to that of Szent-Györgyi, which consisted in extraction of the ground lemon peel with acetone, precipitation with $Ba(OH)_2$, and liberation of the pigment with H_2SO_4 in a small volume of methanol. On standing for several days a white precipitate of hesperidin slowly separated out, accompanied by the bleaching of the solution. This observation, along with others in the course of the work, led us to regard the yellow eriodictin of Szent-Györgyi as the chalcone of hesperidin. This explains the difficulty encountered by Szent-Györgyi in separating hesperidin from his yellow material, inasmuch as there is an equilibrium between the flavanone and its open chalcone isomer:



hesperidin (flavanone glycoside) ⇌ hesperidin chalcone (3,2′,4′,6′-tetrahydroxy, 4-methoxy-chalcone glycoside)

This equilibrium is shifted to the right in alkaline medium and to the left in acid medium. It has been previously observed[4, 5] that the 2′-hydroxy-chalcones exhibit a marked tendency to isomerize to the corresponding flavanones.

The pure chalcone was prepared by dissolving several-times recrystallized hesperidin in cold alkaline solution with subsequent neutralization, upon which the chalcone rapidly crystallized and was filtered, washed with acetone and ether and dried. This crystallization is immediate, whereas the ring-closure proceeds at a much slower rate. The chalcone was obtained in the form of bright yellow microscopic crystals of melting point 251–252° C. (uncorr.), soluble in pyridine, very slightly soluble in methanol and insoluble in water. The chalcone could easily be reverted to hesperidin when suspended in absolute methanol (traces of anhydrous HCl increased the rate of this reaction), and the resulting product gave no depression of the melting point of the original hesperidin (261–262° C.).

An active group such as occurs in the chalcone (—CO—CH=CH—) should be easily susceptible to reduction. Upon solution of the chalcone in pyridine and treatment with small amounts of zinc and glacial acetic acid in an oxygen-free atmosphere, reduction took place rapidly as evidenced by the loss of color. Shaking the solution in air restored the yellow color. This chalcone is, therefore, a member of that class of naturally occurring substances capable of being reversibly oxidized and reduced.

Since most of these substances are associated with proteins as enzymes within the tissues a new method of isolation was developed in order to obtain the intact protein complex. An aqueous extract of lemon peel was saturated with $(NH_4)_2SO_4$ and the resulting precipitate filtered, redissolved, reprecipitated and dried *in vacuo*. This tan powder was exhaustively extracted in a Soxhlet with ether yielding a bright yellow solution and a pale tan residue. The ether-soluble pigment was shown by standard tests to be neither a carotenoid nor a benzopyrone type of pigment and will be the subject of further investigation in this laboratory. The protein residue was extracted with pyridine which served to split the pigment from the protein. This pigment was shown both by physical and chemical tests to be the chalcone of hesperidin. The denatured protein was repeatedly washed and found to give positive reactions to the standard protein tests.

When hesperidin opens to form the chalcone there is established an extensive system of conjugated double bonds, which greatly increases the absorption in the blue and near ultra-violet. Combination of the chalcone with the protein shifted the ultra-violet absorption maxima from 3320 Å. to 3270 Å and from 3080 Å to 3020 Å without altering the shape of the curve. The chalcone forms complexes with other proteins, and it is probable that within the tissues it is

[1] One of us is indebted for a fund from the California Fruit Growers Association.

[2] L. Armentano, A. Bentsath, T. Beres, St. Rusznyak and A. Szent-Györgyi, *Dtsch. med. Wschr.*, 33: 1325, 1936.

[3] A. Szent-Györgyi, *Zeit. f. physiol. Chem.*, 255: 126, 1938.

[4] J. Shinoda and S. Sato, *Jour. Pharm. Soc. Japan*, 48: 791, 1928.

[5] A. Russell and S. Clark, *Jour. Am. Chem. Soc.*, 61: 2651, 1939.

kept in solution by such a mechanism. The chalcone-protein complex was found to be easily reduced by sodium hyposulfite and to be reoxidized by oxygen.

The chalcone-protein and its prosthetic group, hesperidin chalcone, can serve as hydrogen transporters in mammalian tissue. This was demonstrated in the l(+)-glutamic acid dehydrogenase system obtained from liver by the method of v. Euler, Adler, Günther and Das.[6] This system involves l(+)-glutamic acid, apodehydrogenase, codehydrogenase I or II and diaphorase; whether the chalcone is reduced by diaphorase or directly by the codehydrogenase we do not know at the present time. As previously mentioned, the chalcone is autoxidizable and, hence, under aerobic conditions can increase the oxygen consumption of such a respiratory system. Work is now in progress to determine the various respiratory systems in which the chalcone-protein may play a role and the exact location of this substance in the hydrogen transport chain. We believe that this material and perhaps similar substances play a part in tissue respiration of both plant and animal cells.

Finally, preliminary experiments have shown that the chalcone exerts a beneficial effect upon the state of the capillaries, decreasing the fragility and preventing localized hemorrhages.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN APPARATUS FOR CONTINUOUS FILTRATION IN BLOOD AND PLASMA TRANSFUSIONS

DESPITE the use of adequate amounts of anticoagulant, fibrin clots will form in stored blood or plasma. The amount of fibrin will increase with the time of storage, but may be present in blood shortly after it is drawn. The blood and plasma, therefore, must be filtered before administration to prevent embolism.

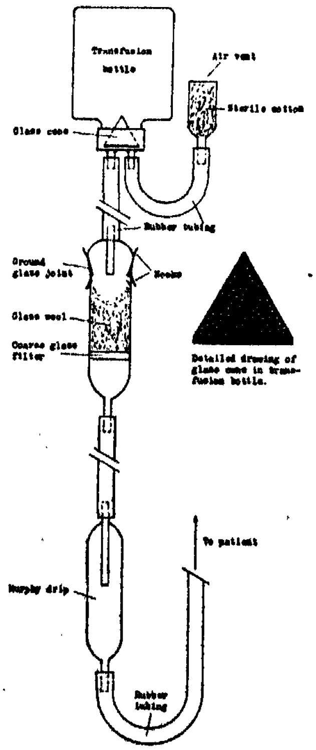

FIG. 1. Diagrammatic sketch of transfusion system, showing apparatus for continuous filtration.

In the methods employed at present, the most widely used materials are cotton gauze and metal screening. In many cases filtration through cotton gauze is carried out in the open air, permitting air contamination with bacteria. Furthermore, cotton gauze offers no uniformity for standardization, and no evaluation as to its pore size is possible. Metal screens, aside from the usual objection to metals for intravenous fluids, have been too coarse to retain all fibrin particles.

We have successfully used a filtering system which is fine enough to remove all fibrin particles. It consists first of a glass cone with coarse openings which holds back the large clots and prevents plugging of the rubber tubing. The blood is then filtered through glass wool (or glass cloth), and a fused glass filter which removes the remaining particles. "Pyrex" glass wool is adequate for this purpose, and, together with the fused glass filter, may be cleaned before use with cleaning fluid. The fused glass filter may be as fine as desired. It may retain the red cells or it may permit their easy passage. We have found that a filter made of fused glass particles, size 80 to 100 mesh, allows the rapid passage of the red cells and is still fine enough to hold back the fibrin particles.

The filtering apparatus permits administration in a closed system from the bottle into which the blood or plasma was drawn originally. This type of filter may be used to filter plasma in the field, either with the transfusion set as illustrated or by any other method. It satisfies the need for an adequate filter in the emergency treatment of shock with plasma.

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[6] H. v. Euler, E. Adler, G. Günther and N. Das, *Zeit. f. physiol. Chem.*, 254: 61, 1938.

BIVALENT TYPHUS VACCINE OF HIGH IMMUNIZING VALUE

BASED on immunologic differences found between endemic and epidemic typhus strains, some authors recommend the production of "epidemic" vaccines as means of practical protection against the infection. Such vaccines have little if any value against "murine" and closely related strains which have been found to originate outbreaks of typhus fever of considerable extent and great severity. On the other hand, by increasing the antigenic content of our "murine" vaccine it is possible to immunize against both types of the infection as shown by Veintemillas,[1] who has found that complete protection can be obtained in men vaccinated against the experimental inoculation by both Mexican endemic virus and Bolivian epidemic typhus.

The results of practical vaccination with "murine" vaccine have not been carefully studied. A considerable number of persons has been vaccinated, but we may draw information from only 5,000. All these cases were potentially exposed to the infection and we know that at least seven developed typhus after being properly vaccinated. From a large group of physicians, nurses and medical students, two vaccinated persons developed mild typhus, while two nonvaccinated students died of the infection. The possibility that the indicated failures might have been due to insufficient cross-protection against some epidemic strains encouraged us to improve our monovalent "murine" vaccine by addition of "epidemic" antigen.

The cultivation of murine virus in the lungs of rats produces amounts of rickettsiae which are far superior to the yield of ordinary bacteria growing in artificial media if we compare lungs and media by weight, but, so far, we have not been able to obtain practical "lung" cultures of the "Breinl" strain, not even in mice. However, we have found that a Mexican epidemic strain is suitable for the production of considerable growth of rickettsiae in the lungs of mice. Pure suspensions of organisms thus obtained have a high protective value against both the "Breinl" and the homologous strains, although it is not satisfactory against endemic typhus. Suspensions which are water-like in appearance have a definite protective effect against the "Breinl" strain. The bivalent vaccine has a final concentration, when ready for human use, equivalent to a turbidity intermedial between Nos. 1 and 2 of the McFarland scale. This amount of antigen produces local and sometimes general reactions in vaccinated persons, but it is well tolerated. When tested in guinea-pigs, it shows a high degree of protection against both "murine" and "Breinl" strains. Since the organisms can be obtained in pure suspensions, the antigenic content of the vaccine can be modified at will. For instance, for field work we distribute a suspension containing 10 times more rickettsiae than that required for human vaccination. Therefore, 50 cc of such stock vaccine is sufficient to start the immunization of 1,000 people. Before use, the concentrated vaccine is diluted in the same syringe with 9 parts of steric isotonic NaCl solution administering a first dose of 0.5 cc and 2 subsequent doses of 1 cc each at weekly intervals. However, this treatment is insufficient for laboratory workers, who require at least 5 doses of vaccine to be fully protected.

The cost of production of the bivalent vaccine is relatively low since the mouse vaccine is only a minor part of the mixture.

In selecting the strain for the preparation of the murine vaccine we found the "L" strain most suitable for the production of large quantities of rickettsiae in the lungs of rats, and the epidemic strain called "42," which has properties equal to the "Breinl" strain, is readily adapted to grow in the lungs of mice. Further modifications in the antigenic composition of the vaccine depend on the results of its application to men.

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THE TYPHUS LABORATORY OF MEXICO,
MEXICO, D. F.

[1] F. Veintemillas, Suplementos del Instituto Nacional de Bacteriología, June and November, 1941, La Paz, Bolivia.

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SCIENCE NEWS

Science Service, Washington, D. C.

AN EXPLODING STAR IN CYGNUS

THE first nova or exploding star to appear in many months has been discovered in the constellation of Cygnus by Dr. Fritz Zwicky observing from Mt. Palomar, Calif. Observatories all over the world have begun observations upon the remarkable changes in this star's spectrum which will contribute to the knowledge of stellar structure and of atomic structure as well.

Not quite bright enough to be seen with the unaided eye, the nova now at eighth magnitude is probably as bright as it ever will get. Inspection of astronomical photographs at Harvard Observatory show that it had been photographed more than fifty times since June 8 when it was of about tenth magnitude.

Dr. Harlow Shapley, director of Harvard Observatory, stated that "It is likely that the nova reached its explosive maximum in early spring when too near the sun for discovery. During this summer it has been oscillating between the seventh and eleventh magnitudes. Ultimately it will fade away. Its distance is probably greater than a thousand light years."

Dr. Walter Adams, director of Mt. Wilson Observatory, reported the discovery to Harvard Observatory, whence the news was distributed by radio and telegraph to observatories both in the Americas and in Europe and Asia. Lund Observatory in Sweden relayed the information to observatories in both United Nations and Axis countries.

The spectrum of the nova shows bright bands with multiple absorption components. A complete curve of the light variations is being prepared from the Harvard photographs.

THE SCARCITY OF PHYSICISTS

ONE good physicist is bred per year per million inhabitants.

This estimate, made by Sir Lawrence Bragg, of Cavendish Laboratory, Cambridge, England, was based on the number of physicists turned out annually by the British universities, and is confirmed by the Central Register of the Royal Society, which corresponds to our National Roster. At the beginning of the war, the British had listed 1,200 physicists in a population of 45,000,000. Assuming an average working life of thirty years, this comes also to about one per million per year.

A survey made in the United States in connection with the National Roster of Scientific and Specialized Personnel shows that one good physicist in a million men applies to the U. S. A., too.

This ranks the physicist among the scarcest of war "materials." The demand in both England and America exceeds the supply, and the universities have been pressed to train as many men as possible to fill the gap. The physicist, like the poet, is born and not made, an editorial in *Nature* contends. He can not be made on demand by any system of training. However, the British editorial argues, Sir Lawrence Bragg's definition of a good physicist as "a man capable of independent thought, with a flair for his subject," has set the standard too high. Many of the tasks for which physicists are required can be very adequately performed by men and women less gifted.

There has been a very substantial increase in the size of the physics classes in British universities and colleges. While this may not add materially to the numbers of "good physicists" it will add substantially to the numbers available for the more routine but no less important posts for which originality of a high order is not necessary. And this will enable the strictly limited number of men with a real flair for research to be assigned to the tasks that they alone can do.

THE TREATMENT OF CANCER WITH X-RAYS

THE experimental treatment of cancer with x-rays generated by 3,000,000 volts of energy was described at the Chicago meeting of the American Roentgen Ray Society by Dr. Richard Dresser, who reported that the high intensity of the ray created by the experimental machine permits a depth dose much greater than has been obtained even with great amounts of radium; and by Professor John Trump, of the Massachusetts Institute of Technology, who described the physical characteristics of the extremely short ray. Operating on the electrostatic principle, by which static electricity is produced by friction, the apparatus is insulated by air under pressure.

A small number of selected patients have been treated with rays created by the new machine. Dr. Dresser stated that the 3,000,000-volt x-rays have essentially the same physical properties as gamma rays of radium. The penetrating effect of these rays of such extremely short wave-length is such that the maximum therapeutic treatment effect occurs not on the patient's skin, but some distance below in the subcutaneous tissue. Thus the new machine may make possible larger doses of radiation directed at deep-seated cancers with proportionately less effect upon the skin and adjacent normal tissue.

These preliminary clinical findings substantiate the observation that as the wave-length of an x-ray beam is decreased, the skin tolerance and depth dose are increased.

LARGER SUGAR CROPS

SCIENTIFIC control has been developed by Dr. Harry Clement, of the Hawaii Agriculture Experiment Station, whereby plantings of sugar cane in any location may be consistently made to yield 100 per cent. of the theoretical yield.

In the beginning of the study a field experiment was set up to show the relative importance of soil and climate. This experiment was unique since the type of climate in the two fields differed radically, although they were only a few miles apart. The temperature of the areas was the same, but one had a low rainfall and high sunlight intensity, while the other was a cloudy region with moderate rainfall. To make sure that the soil for the crops

was identical, dirt from one was transported to the other. When cane was grown in the two soils under the same climate conditions, the yield was the same. Yet, when cane was grown in these two soils in their respective climates the one yielded 134 tons per acre of good quality cane while the other gave only 65 tons of medium quality.

All attempts to correlate the differences in growth with soil, nitrogen, phosphorus and calcium levels in the plant were without success, but an almost perfect correlation (.999) was obtained when the physical factors of leaf area, crop density and sunlight were considered.

Thus it was evident that yield and quality are dependent, largely, on the atmospheric energy absorbed by the plant. Since the amount of atmospheric energy varies from season to season and from year to year, it is clear that the growth and quality of the plants will also vary. It follows, then, that the index to the fertilizer program lies in the plant as it integrates the influences of the atmosphere.

A system of indices has been established for sugar cane which makes possible the continual adjustment of practices to requirements. The primary index, the sugar content of the sheaths of certain young leaves, reflects the balance existing between the metabolism of the plant and energy available. When this index is normal (about 10 per cent. sugar, dry weight) the plant is growing at the desired rate for the particular climate. If the index rises, the plant is building carbohydrates at a faster rate than it is using them, that is, it could be growing faster than it is. If the index falls below normal, the plant is growing faster than it should and hence quality suffers.

Whatever the primary index shows is the key to adjustments. If the index is abnormal, secondary indices for moisture, nitrogen, etc., are consulted for the cause, and correction in irrigation or fertilizer applications are made accordingly while the crop is still in the fields.

Using this program, much of the guess work in crop management is eliminated. Economically the program pays for itself many times over in saving of fertilizers and of water, not to mention the high yields of good quality crops.

THE EXTERMINATION OF INSECTS

THE farmers' annual blitz season is on. The enemy? Hordes of Oriental fruit moths, potato fleas, boll-weevils, cotton leaf-worms, Japanese beetles, velvetbean caterpillars and hundreds of other varieties of insects. However, the latest communiqué of the Department of Agriculture reports that everything is under control, with only a little mopping up still to be done.

A fresh infiltration of wheat-eating Hessian flies, sweeping east from Kansas to Pennsylvania, are being thwarted by a drastic scorched-earth policy. Since this newest menace is nourished in its larval stage by the juice of tender young wheat stalks, it can be combatted by the ruthless destruction of "volunteer" or random between-crop growths of wheat which offer breeding ground to the thirsty Hessian maggots. It is also circumvented by "delayed seeding," since a touch of frost is harmless to wheat but slows down flies.

Our important wartime crops of peanuts and soybeans have been menaced by white-fringed beetles, leaf-hoppers and velvetbean caterpillars, which can be dusted with cryolite from low-flying airplanes. The white-fringed beetle is a new importation from South America, which research experts in Agriculture's Bureau of Entomology and Plant Quarantine believe is now under control.

The beetle called grape colapsis, fond of soybean in its grub stage, can be foiled by rotation of crops. The cotton season has presented, in addition to the annual boll-weevil menace, an urgent epidemic of cotton leaf-worm, or Alabama ardillacea, which migrates annually from the tropics. Thanks to calcium arsenate, dusted from airplanes, this is now under control, except for the northern edge of the cotton belts. Entomologists are now working on a new cotton pest—the pink boll worm. Except for a few enemies such as the gipsy-moth, crickets and grasshoppers, government entomologists content themselves with research, information service and regulation of harbor and inter-state plant quarantine, letting the farmers carry on the actual warfare.

The innumerable pests which eat stored grain, wool and tobacco in warehouses are an ever-present problem, requiring a vigilant policy of fumigation and "dusting the air" with arsenate compounds.

Although nicotine bentonite is sometimes used in spraying fruit, the most common defense weapon is arsenic, now being absorbed by the war against human enemies. Although no shortage of arsenic has been felt so far, farmers and government experts are not too hopeful about next year's supply.

Fruit pests alone number between 250 and 300 varieties, while another myriad of species attack potatoes, vegetables and all forms of truck crops. Booby traps composed of poison bait are used for some varieties: spraying, dusting, rotation of crops for others. The corn earworm can sometimes be taken in by breeding longer husks on corn. Those worms you'll be eating with your apples this fall are most apt to be youthful codling moths or Oriental fruit moths.

ITEMS

THE unusual dampness which in most agricultural areas had delayed the maturing of crops, and aroused fears of frost damage should frost come early this year, have given way to good growing weather—warm and with plenty of sunshine. According to reports issued by the U. S. Weather Bureau, in some places corn grew twice as fast as normal for this time of the year. On the whole, in fact, growing conditions have been unusually favorable throughout the whole season, and crop yields 12 per cent. higher than in any past year are predicted. If the fall weather continues good, the final yields may exceed present forecasts. In any case there is a big harvesting job ahead.

QUANTITIES of precious copper, zinc, lead, nickel, tungsten, chromium and other strategic metals are being rescued from low-grade deposits and mine wastes by air bubbles, which float them to the surface. The low-grade ores are ground in water and small amounts of chemicals are added which selectively attach themselves to the grains

of the valuable minerals and float them to the surface. This process of "froth flotation" has been used for many years, but E. I. du Pont de Nemours and Company announces the development by themselves and others of new chemicals which improve the process and make it more economical. The precious minerals are skimmed off the surface and subsequently smelted and refined, thus adding to the supply for our war implements.

To insure production of the highest quality of dehydrated foods for the armed forces of the United Nations, the U. S. Department of Agriculture announces the opening at Albany, N. Y., within the next few weeks of the first school to train commercial manufacturers in improved methods of processing developed in government research laboratories. Because of the urgent need to conserve shipping space and to prepare foods in a form which will keep indefinitely in any climate, the training program will be expanded sometime this fall to include a school at Rochester, N. Y. The training program is being jointly conducted by the Agricultural Research Administration and the Agricultural Marketing Administration, which is the Lend-Lease purchasing agency. Subjects included in the courses will be selection of vegetable varieties, storage problems, processing, packaging and laboratory control, to provide maximum quality for this fuel for the fighting men of the United Nations. Recent improvements in dehydration processes make possible the shipment of dry vegetables, milk, meat and other foodstuffs in only a fraction of the space formerly required. Yet when mixed with water at the battle front, they are reconstituted with nearly all the nutrient value and fresh flavor still intact.

THE death rate from tuberculosis in the United States continues to decline, despite an upswing of cases in European countries, according to the report of the National Tuberculosis Association. Last year 44 persons died of tuberculosis for every 100,000 population, compared with 46 the previous year. This totals 59,173 persons dead and 105,714 new cases reported. Despite continued improvement in the death toll, there is slowing up of the downward trend of cases in this country. Dr. Kendall Emerson, managing director of the association, points out that under wartime conditions tuberculosis may show an increase here, just as it already has in warring countries of Europe. Various theories have been offered to explain the increase abroad. Among them are decreased resistance, due to longer hours of work, strain, anxiety, inadequate diet, broken rest, overcrowded homes and shortage of medical and nursing personnel. There is every reason to believe that, as the war goes on, these factors will operate in this country unless voluntary and public health authorities are able to use all their resources. Every effort is being made to keep tuberculosis out of the armed forces. Army doctors are fully equipped for x-raying and are authorized to reject all those who may have or who have had the disease.

SCIENCE

Vol. 96 | Friday, October 2, 1942 | No. 2492

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

MOLDERS OF A BETTER DESTINY[1]

By Dr. CHARLES M. A. STINE

VICE-PRESIDENT AND ADVISER ON RESEARCH AND DEVELOPMENT, E. I. DU PONT DE NEMOURS AND COMPANY, INC.

In fighting a war, the all-absorbing intent is to win. There is little time to analyze the rush of events or to appraise their consequences beyond the war's end. The united objective is rightly success for our arms.

Yet under the pressures of a great war there may be compressed scientific, economic and social developments that might have taken many decades to achieve under less urgent conditions. Their effects on our lives and all civilization may be more wide-reaching and lasting than any military conquest. They constitute one of the most imperative incentives to victory.

No American, least of all any scientist worthy the name, conceivably could endorse war as a justifiable means to progress. The destruction of life and property wrought by the present war far exceeds the havocs of a century's earthquakes. Most of mankind is burning itself on an altar of paganism.

Nonetheless, one fact is inescapable. Despite the recurrent malady of war, history's over-all course is forward. Mankind has the habit of rising phoenix-like from its own ashes to attain greater heights. Progress is immortal.

We emerged from the First World War with a wholly new concept of our possibilities. For the first time we began clearly to see that when the Creator conferred upon man freedom of choice and action, there were placed in man's hands the tools with which he could shape his destiny and modify his future. We learned that it was possible not only to emulate nature but even to excel her in certain fields of creation. We were shocked at how little we knew and at

[1] Address before the General Session of the American Chemical Society, Buffalo, N. Y., September 7, 1942.

how meagerly we had advanced in the light of what was still to be accomplished.

The new nation—and it was no less—that was built on this continent following 1918, largely as a result of the war-broadened vision, would have seemed a fantastic wonderland in 1914 had anybody then had the imagination to predict it.

The automobile came of age; aviation was established as a potent industry; the "wireless" of war days became "radio," and radio approached the miraculous in the marvel of television. Add to these the gigantic expansions realized by the telephone, the motion picture and rayon, all three of which were undeveloped infants in 1914, and you have a combination of influences truly staggering in their effects upon American life.

One of the greatest migrations of all time took place as millions moved from farms to cities and more millions from cities to suburbs. This mighty trek, made possible by improved transport, better highways and opportunities for more lucrative employment, paralleled further drastic changes in our traditional economy. We had led the world in agriculture; we now led it also in industry. Mass manufactures superseded the handicrafts almost to their extinction.

Meanwhile, the American woman had taken her destiny into her own hands. In 1914, she wore long skirts, cotton stockings, whalebone stays, and her "place was in the home." She came out of the war with a declaration of feminine independence that has since taken her to Congress, into the Cabinet and into almost every activity once sacred to man, including the military. In less than a decade she cut the bonds of centuries and destroyed for all time a hundred circumscribing taboos. Only the future historian can assess the full impact of this new freedom upon the family, the community and the nation. It was undoubtedly speeded to fruition by the First World War.

There were other advances—you are as familiar with them as I am. When we, the American people, on the seventh day of December, 1941, found ourselves again at war on a global scale, we were living on a plane that bore but little resemblance to the pre-war period of a quarter century earlier. Our clothes, our food, our homes were different. The character of our work was changed. Our environment and thinking were those of a new age.

Millions of dollars had become hundreds of millions in our national planning. Private industry risked tens of millions on ventures that earlier would have commanded hardly a tenth as much. Hosiery and furniture alike were being made from coal, water and air; dresses from wood, farm fertilizers from the atmosphere, camphor from pine stumps. These and many other achievements of chemical synthesis had altered or made obsolete trade practices and customs as old as the race.

Moreover, the scientist was just getting started. Tens of thousands of new chemical compounds and metallic alloys awaited his full exploration. We were speculating on the eventual conquest of disease. The elimination of poverty, at least as a social problem, was considered a goal that well might be realized. And, as organic chemistry was the source-spring of a major share of the infinitude of changes that inspired such hopes, the influences of the First World War could be very definitely traced here also. Our organic chemical industry in the United States grew directly in answer to needs made violently evident by that war.

It is unnecessary to detail to chemists what has happened in chemistry since 1914. That year, a mere handful of 528 workers made up the nation's total employment in the production of coal-tar chemicals. American-made dyes were not even listed in the official census reports. Our farmers had to buy German potash and Chilean nitrate. Our physicians looked to Europe for important drugs, sutures and optical glass. All science looked to Europe for leadership.

Indeed, it was a simple, almost a scientifically primitive economy in which we Americans then lived. On all the seven seas, America-bound ships heavy with goods and raw materials testified to our dependency on foreign lands. The homes in which we lived differed little from those of our great-grandfathers; the tailors of the Caesars knew the textiles of which we made our clothes; the finishes of our 1914-model horseless carriages dated to ancient Egypt and the building of the Pyramids. All steel rusted. The best rubber tires were worn out after about 3,000 miles of highly uncertain road service.

One shudders at what might be our plight if those were the tires of to-day, or if by some colossal blunder we had failed to establish an organic chemical industry in the United States as a consequence of that other war's bitter lessons.

Thank God, we did establish a chemical industry!

We did more than that. We established a nationwide common consciousness of the power of science in every branch of American industry. Steel, textiles, transportation, foods, oil, in fact, every basic producer came to the turn in the lane where all signposts of progress pointed in one direction—to the research laboratory. We did not get there all at once, but most of us got there long before German hobnailed boots were pounding over the streets of Warsaw.

Expenditures for industrial research in the United States rose from an inconsequential sum yearly in the pre-First-World-War period, to an amount estimated

at 300 millions of dollars yearly in the pre-Second-World-War period. The number of research laboratories grew to more than 2,000. Huge sums were spent in expanding technical and scientific schools to meet the demands of our awakened youth. The number of doctorates granted in chemistry alone was multiplied by twenty or thirty times.

I am not implying that all research is chemical or that chemistry provides the one Aladdin's lamp which all scientists must rub. However, let chemistry be ignored and the other lamps become lifeless brass. Perhaps the greatest benefit that has come to America from our chemical awakening is the renascence of all science that has accompanied it. The chemical synthesis of vitamins, for example, to say nothing of hormones and the sulfa drugs, not only is revolutionizing medicine and dietetics but putting these sciences on incomparably higher planes of performance and future promise. And at the opposite extreme of the pendulum's swing, the modern long-range bomber, while a machine, is also a composite chemical triumph expressed in metals, plastics and liquids.

The famous tribute paid Washington—first in peace and first in war—might be paid with equal justice to chemistry. Its record during our other world war is history. Its contributions to the nation's progress during the peaceful years of the '20's and '30's while the organic chemical industry grew to maturity, helped crowd into those years many of the most notable advances that mankind has gained since civilization began.

Now, we are again at war. With the full strength and vigor of its young manhood, the chemical industry is fighting again for an American victory and an American peace. To this task wholly it has dedicated itself wholly.

And we hear questions: Is the fight worthwhile? Will a victorious peace be worth the price that all too evidently we will need to pay for it? After victory—what?

My answer is that now, to-day, even as I speak, the pressures of this war are compressing into the space of months developments that might have taken us a half century to realize if necessity had not forced the pace.

Those pressures are unprecedented. The developments are unprecedented. Give us a victorious peace and the freedom of enterprise it should guarantee, and our progress will be unprecedented!

One does not need to venture into prophecy to sketch the bold lines of what that progress can be. They have already been traced. Already our world of 1940, in which we took such pardonable if mistaken pride, is so distant in the past that it has become an antiquity, as seen through scientific eyes. The inconceivables of two years ago are to-day's realities.

More than a century was consumed in bringing the crude rubber production of the world up to a million tons yearly. The United States alone is now undertaking to accomplish almost as mighty a feat in less than two years, by the manufacture of chemical rubbers from petroleum, alcohol and coal and limestone.

By the end of 1943, our production of aluminum will be at a rate almost seven times greater than was attained in 1939 after fifty years of intensive development. And we will be recovering from brine, sea water and other sources approximately 100 times the amount of magnesium that was produced in 1939, when the magnesium industry in America was 24 years old.

Our aviation industry is establishing facilities for the manufacture in one year of almost double the number of planes it produced throughout the 37 years of its history beginning with the Wright brothers at Kitty Hawk and culminating in the Defense Program. Meanwhile, largely as a result of chemical advances in fuels, plastics and light metals, aircraft engineers are designing trans-oceanic planes capable of flying to Europe and back non-stop, carrying payloads of 20 tons. The projected planes are quadruple the size of the famous "Clipper" planes that pioneered in inaugurating transatlantic commercial air service.

The nation will emerge from this war with capacities for making plastics, synthetic fibers, nitrates, hydrocarbons, high octane gasolines and literally scores of chemical and other raw materials on a scale that only two years ago was beyond our comprehension. The changes that have taken place in our thinking and planning approach the unbelievable when one detaches himself from the present long enough to regain the viewpoint of only the recent past. The first proposal that we build 50,000 war planes left us incredulous. We asked how could we maintain such a vast fleet, even should it be built, or train the men to fly it. Now, the demand for 125,000 war planes in a single year is met with the answer, "Give us the materials and we'll give you the planes, as ordered."

In terms of dollars, the hundreds of millions of that bygone economy stemming from the First World War have suddenly become tens of billions! A million dollars is hardly pin-money in our planning!

Few of us, even among scientists, grasp the technical implications of these enormous projects which are becoming facts with emergency speed. The aluminum-producing capacity being created will furnish in one year metal enough to build thrice the number of passenger cars now operating on all American railroads. To produce this aluminum will require more elec-

tricity annually than was consumed in 1940 in 27 of our 48 states. Despite wartime tax schedules and wages, aluminum ingots now cost 25 per cent. less than in 1940, and further economies are forecast through savings in fabricating costs. Aluminum has become a major metal.

Magnesium is about 60 per cent. the weight of aluminum and about one fifth the weight of steel. It sold, in 1915, for $5.00 per pound and until a few years ago was a structural curiosity. To-day, measured by cubic feet, magnesium at 22½ cents a pound is cheaper than aluminum selling at 15 cents a pound, and almost a half ton of it, on the average, is going into every American fighting plane that is built. After the war, the nation's capacity for producing this lightest of all structural metals will be more than double its aluminum output of 1939.

Equally significant is the source of most of the magnesium now employed industrially. For the first time in the history of the world a structural metal is being obtained from the sea by a chemical process. Huge pumps force 300,000,000 gallons of sea water daily through intricate apparatus. At present, magnesium and bromine are the only products precipitated, but ocean water contains traces of every element found on land. Are we opening a new field of chemistry, far more bizarre than any of the imaginings of fictionists? Nobody knows as yet.

In turn, steel is challenging the light metals. Low alloy steels and new modifications of the higher alloy steels, fresh from the laboratory, are bidding for expanding uses in aviation and wherever lightness and strength are requisites. In the steel industry to-day, technicians speak confidently of monster aircraft that will be largely steel. These new alloys are three times the weight of aluminum and almost five times the weight of magnesium, but their tensile strength approximates 190,000 pounds to the square inch. This advantage permits weight to be shed by reducing bulk and eliminating needless supports.

The larger planes grow in the future, say the chemists of steel, the more pronounced will be the trend to the new steel alloys. Less subject to corrosion than plain steel, they are more easily corroded than aluminum, but this problem in protection is said to be on the way to early solution. So watch steel in the mounting competition of light metals.

By all means, too, watch petroleum. Some years ago it was believed that the ultimate in motor fuel would be reached by the creation of a gasoline equivalent in power and anti-knock qualities to pure iso-octane. So superior was iso-octane in these respects that it arbitrarily was given an octane number of 100, which became the standard in evaluating all gasolines. But that was before the Battle of Britain.

The epic fight of the Royal Air Force to save England, raging month upon month against odds, was also a chemists' fight to produce better fuels—fuels that would get planes into the air in a fraction of the former time, that would give greater and yet greater speeds, longer and yet longer ranges. The American chemist was in that fight because he knew more about motor fuels than any other chemist on earth. The Battle of Britain became a testing and development laboratory in which a nation's life was the stake.

The work done in that laboratory, and in our laboratories here at home as an outgrowth of that experience, has precipitated changes in motor fuel technology of which the effects will be reverberating long after the peace. Fuels now can be made that go beyond the octane scale. Their estimated octane numbers are of the order of 110 or 115 and even higher. They deliver one half again as much power as 100 octane fuel. Looking upon the situation that is indicated for after the war, the petroleum chemist now sees all existing motors as out of date, with knowledge of fuels advancing so rapidly that September's motor might be out of date in October.

Let us glance at another phase of petroleum chemistry. A barrel of crude oil contains literally thousands of chemical compounds. The chemist has long been fascinated by the possibility that almost anything under the sun might be created with these chemical building blocks of hydrogen and carbon; that simply by the addition of oxygen and other elements in the proper combination, he might obtain new alcohols, esters, acids, solvents, perfumes, pharmaceuticals and organic synthetics of every type. Catalytic cracking processes and adaptations of them, brought very recently to high stages of performance, are now leading toward this goal and taking petroleum chemistry into a realm once exclusive to coal-tar chemistry.

The largest catalytic cracking capacity in the world is being operated by American oil companies. Soon this capacity will approximate some hundreds of thousands of barrels daily. The significance of this development, well underway in 1939 but expanded to gigantic size by the needs of war, is beyond all present vision. Synthetic rubber, which, as every chemist knows, is not rubber at all but a new material of broader and yet more promising utility, is being produced from butadiene and styrene synthesized from petroleum. Toluene, best known as the basis of one of the most important of modern high explosives but also essential in dye chemistry and many other industries, is now a petroleum product.

With almost equal facility the petroleum chemist can give us ethylene, on the one hand, or benzene on the other, and supply them in quantities measured in hundreds of tons daily. This feat might be likened to

drawing wine or water at will from the same cask, or getting beef or pork from the same animal, inasmuch as ethylene and benzene are members of quite different chemical families. Practically, they are employed in such diverse uses as the manufacture of styrene plastics, both the Buna and Thiokol types of synthetic rubbers, drugs, dyes and nylon. Moreover, acetylene can be produced from refinery gases to furnish the principal intermediate in the manufacture of neoprene.

Germany's early mastery and world monopoly of the production of benzene, toluene and other coal-tar crudes and intermediates—her then "secret weapon"—brought her armies almost to victory in the First World War. It was only by prodigious effort and at huge cost that private industry in the United States was able, during and after that war, to win independence in these chemicals, which are part and parcel of the nation's economic life-blood both in peace and war.

To-day, we are doubly independent. Our coal-tar chemical industry is securely established. In addition, the possible output of benzene and toluene from petroleum is many times their peak output from coal tar. Furthermore, in super motor fuels, which may well be this war's deciding weapons, we are excelling the enemy's best in quantity and quality alike. Where Germany stood in 1914 with coal tar, the United States stands to-day with petroleum.

A sign of the swiftness of the pace with which the hurly-burly of change is sweeping the petroleum industry is given by a printed card that now hangs behind the desk of the research director of one of America's greatest oil companies. The card reads: "You don't have to be crazy to work here, but it surely helps!"

May I add that a similar card could be hung with profit in every American office and shop and laboratory and farm barn. We are going to need to be "crazy," as judged by 1940's thinking, to make this upset world right again. We are going to need to be visionary to the point of audacity, in the light of to-day's evident facts, to discharge just a fair share of the post-war opportunities and responsibilities.

Plastics were of sensational promise before Pearl Harbor. The newest and most versatile of plastics will be available after this war on a scale beyond all previous conceptions. The high-pressure synthesis of ammonia, one of the major chemical exploits of the century, will have taken on an industrial status that, in terms of new producing capacity, may be comparable to the discovery of a sixth continent. The amount of fertilizer chemicals that this new capacity will be able to supply farmers for fertilizers will be so large that the basic trends of agriculture might be changed. And these are but one group of a hundred or more products stemming from this high-pressure synthesis, which utilizes air, water and coal as its building blocks.

We will have glass that is unbreakable and glass that will float, wood that won't burn, and laminations of plastics and wood that will compete with the structural metals. Hosiery derived from air, water and coal, a wonder of pre-war days, is but the forerunner of many innovations from the same source, ranging from shoes that contain no leather and window screens that contain no wire, to machinery bearings that contain no metal.

At the moment, we are handicapped by shortages. Scarcity as such is not the reason for them, however. Never has there been so great a plenty as measured by our ability to produce, and that ability grows by the hour. The shortages are the consequences of the diversion of goods to war, and from ourselves to others. To-day, we produce to destroy.

But to-morrow we will produce to build, and we will continue to invent and thus to multiply our possessions. Released by an American victory, the stream of production, compared with its volume in the past, will be as a great river is to one of its tributary creeks. We will have at our command ten, fifty, a hundred times what we had before, chiefly of new materials.

That prospect is as certain as to-morrow's dawn. We need only to make the victory definite. Then, the choice will be ours, either boldly to harness the stream of plenty, or, if we are timid and of myopic or restricted vision, to be embarrassed by the very abundance of means we have created.

If I know the American chemist, his will be the bold course—the course toward a better destiny. And all science will set its course by the same compass!

Possessing the tools, the experience and the knowledge that we now have, we should be unfaithful servants indeed if, upon the coming of peace, we merely buried the talents charged to our keeping. Means will be at hand to perform feats that men have long dreamed of doing.

Fuels and metals and plastics are now ready to complete the revolution in transportation begun early in the century. The automobile manufacturer's slate has been wiped clean for a fresh start, which should result in new cars that will be of incredible efficiency as judged by present standards. Since motor car production stopped, the shiny new models that are now gathering dust in dealers' storerooms have aged, technically, at least two decades. We are now in the 1960's of motor cars, as measured by the old pace of development.

Sealed cooling systems, proved on large-scale by aviation, may end in the post-war car the nuisance of adding water to radiators. Weights may be half what

they are, saving from 1,500 to 2,000 pounds of useless load. The power output per cubic inch of piston displacement may double, treble and even quadruple. Fuels may yield 50 miles to the gallon or better.

In the oil industry they are speculating on fuels with octane ratings of 150, or almost twice that of the best automobile gasoline of two years ago. They say gasoline itself may be displaced by a superior petroleum product. They are talking of the practicability of midget automobiles for children.

Instead of rubber alone, there will be a hundred and one rubbers for tires and other uses. In tires, the indicated range is from all natural rubber casings, through varying combinations of natural rubber and synthetics, to the all-synthetics. When one remembers that at present the synthetics are being adapted to tire specifications written for rubber and that the truly synthetic-type tire is yet to be engineered, the prospect is one of progressive changes.

The upsurge of automobile technology will be paralleled in aviation. Designers are thinking in terms of hemisphere-spanning freighters and of passenger air-carriers in fleets numbering hundreds of planes. Transcontinental non-stop air trains of gliders, which would drop off or pick up "coaches" over the principal cities enroute, are no longer figments of an imaginative air man's dream. They are probabilities. Leaders of the industry say that technical considerations no longer limit the size of airplanes that can be built.

Now present are most of the elements essential to the wide popular ownership of planes. Small, highly efficient, almost foolproof craft can be produced at low cost. An enormous plant capacity will be awaiting utilization, tens of thousands will have been trained in flying, and the post-war land will be dotted with air fields. Only within very large cities will we be deficient in field facilities, and there too the signs of impending change are clear.

As never before we are conscious of the need for cheaper and better housing. Crowded city slums stand as an ugly reproach to our lack of initiative and vision in home-building. The slums should be emptied after the war by the combination of forces that is being arrayed against them; and once empty, airports might well take over those bleak blocks.

Lower-cost motor cars, which will draw still more thousands of city dwellers to suburbs and country, represent one of the forces that is going to help empty the slum. Public opinion, shaped by a more enlightened conception of the basic needs of healthful living, is another. The third will be the better housing that so long has been awaited. It is coming.

It is coming because in no better way will we be able to put into worthwhile service the abundance of materials suitable for building all kinds of things. The very prospect of this plenty, on the one hand, and the all-too glaring lack of inexpensive modern housing on the other, have started men thinking who have given but little attention to this problem in the past. The engineer, the chemist, the production expert and the development departments of some of our largest companies are alert to an opportunity, and will become productively interested the moment the war releases their services.

Thus far, only general objectives have taken form. They are for homes costing in the order of $500 to $800 per room. Prefabricated sections, which can be easily handled by two men, will permit flexibility in architectural designs. New insulating materials, making possible light walls that will be several times as efficient as heavy masonry ones, will allow the use of revolutionary structural principles.

Plywood, plastics, rustless steels, non-ferrous alloys, various types of composition board, fire-resistant woods, ceramics and synthetic finishes of lasting durability will be employed in profusion. For example, stainless steel is indicated as a common roofing material of the future. It will last as long as the house and require no maintenance. Lighting will be automatic, governed by electric "eyes" sensitive to outside variations in the daylight. Air-conditioning units will filter out the pollens of hay fever and asthma.

The movement for better homes marches side by side with that to educate the public in better diet. I venture to say that more popular training in the chemistry of food and its digestion has been crammed into the past two years than was given in the preceding two centuries. The knowledge of food's real values to the body that is flowing from sound scientific studies of broad scope is accumulating means of incalculable power to prolong life.

Science, too, follows the flag. This war, spreading over all zones and into all climates, presents a challenge to American medicine that is without precedent. That challenge is being met by a mobilization of all the sciences that likewise is without precedent in man's fight against disease.

The weapons being employed are unique to our time. They include the ultra-centrifuge, in which there is a peripheral speed of the rotating disk comparable to the velocity of a rifle bullet. Still another is the electron microscope, the largest of which now being built at Stanford University is expected to magnify 150,000 times. Mention should also be made of the giant cyclotrons, sometimes referred to as "atom smashers," with which it is possible to transform certain ordinary elements into wholly different elements possessing

radioactivity. In addition, synthetic organic chemistry is making an ever-increasing and significant contribution to remedial medicine.

The single objective of this mobilization of science against disease is to prevent suffering and save human lives, irrespective of color or creed. The results which are certain to accrue may ultimately outweigh by many times even the staggering losses of the world-wide conflagration.

Taking an over-all look at the current press of events, one notes that, perhaps, the most important of all the signs pointing to better days is the fact that the emergency of war has dissipated innumerable inertias, each an interruptant of progress. Normally, the new is received with suspicion. People cling to the old and tried, are loath to experiment, slow to change. With peace, however, the usual slow developmental process will have been reversed. War shortages of conventional materials will have resulted in eager trials of every new material science and industry could offer. And countless of the "substitutes" will have proved their superiority. Thus, an experience with and an acceptance of the new will have been gained that ordinarily might have taken many years to achieve.

No doubt, some will become alarmed over the possible displacement of old materials and old industries. Changes of a drastic nature are inevitable, but they seldom result in the hardships that the timid predict. More wrought iron is being used in the world to-day than when wrought iron occupied the province now held by steel. The horse and buggy vanished, but the buggy manufacturers who were alert rose to new affluence with the motor car. The coal-tar colors ended the centuries-long reign of natural dyestuffs, but the dyestuffs industry has grown to many times its former size, and spawned a dozen new industries in addition.

Progress means going forward. It must build more than is destroyed or it does not merit its name. Not only should it be of a tangible, material character, but it should contain the elements of greater spiritual growth for the individual and community alike. It should lift the chin and put a new spring into humanity's step.

The President of the United States has said that we are fighting for four freedoms—freedom from want and freedom from fear, freedom of speech and freedom of religion. A former President of the United States, Herbert Hoover, has added that a fifth freedom is also mandatory in the victory—freedom of economic enterprise.

The scientist accepts these freedoms unreservedly. To their attainment he is glad to give life itself, if that is the price. But the scientist is fighting just as wholesouledly for five hundred, yes, for five thousand other freedoms.

The freedom to work, to expand the intellect, to worry through with a theory until it is validated or disproved; the freedom to banish the wasteful and enthrone the efficient; the freedom to improve, if he can, everything that exists under the sun, and beyond that to create things upon which the sun has never before shone—these, too, are freedoms for which the true scientist fights.

As a man, he fights for the freedom to better his lot and for the rewards that ability merits. As an incurable altruist—and the true scientist is one—he fights even harder for the freedom to better the lot of mankind, that each generation may rise to heights loftier than any won by its predecessor.

A soldier of peace, he fights for the freedom to mold a better destiny, both for the individual and for the race.

These freedoms have always been America's. We fight to keep them America's. Let our swords be mighty, and mighty indeed will be our plowshares.

SCIENTIFIC EVENTS

RECENT DEATHS

Dr. Thomas Milton Putnam, professor of mathematics at the University of California, died on September 22 at the age of sixty-seven years.

Dr. Homer Clyde Snook, consulting engineer of Summit, N. J., known for his work on electronics, died on September 22 at the age of sixty-four years.

Dr. Edward Fawcett, since 1934 emeritus professor of anatomy, previously from 1909 to 1934 dean of the faculty of medicine at the University of Bristol, died on September 22 at the age of seventy-five years.

Dr. David Waterston, since 1914 Bute professor of anatomy at St. Andrews University, died on September 4 at the age of seventy-one years.

TECHNOCHEMICAL LECTURES, 1942–1943, OF THE MELLON INSTITUTE

A series of lectures on recent advances and current trends in the American chemical industry will be presented by technologic specialists of Mellon Institute of Industrial Research during 1942–1943. These discourses, which will be delivered on alternate Wednesdays, in the fourth period (11:30 A.M.–12:30 P.M.), throughout both semesters, in the auditorium of the institute, will be open to all students in the profes-

sional courses in chemical engineering and chemistry in the University of Pittsburgh, as well as to the institute's members.

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October 7. War Problems of the Chemical Industries, Dr. E. R. Weidlein.

October 21. Recent Changes in the Manufacture of Heavy Chemicals, Dr. F. W. Adams.

November 4. Present Importance of the Synthetic Organic Chemical Industry, Dr. B. G. Wilkes.

November 18. Opportunities in Fuel Conservation, Dr. H. J. Rose.

December 2. Chemical Technology of Petroleum in Wartime, Dr. W. A. Gruse.

December 16. Advances in Manufactured Gas Production, J. A. Shaw.

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January 6. Synthetic Resins To-day and To-morrow, Dr. R. L. Wakeman.

February 17. Our New Synthetic Rubber Industry, Dr. Claire LeClaire.

March 3. Vitreous Enameled Products as Engineering Materials, Dr. E. E. Marbaker.

March 17. War Problems in Building Materials Technology, Dr. H. E. Simpson.

April 7. Economic Status of Heat-Insulating Materials, R. H. Heilman.

April 21. Solving Corrosion Problems in the Chemical Industries, Dr. G. H. Young.

May 5. Progress in Sanitary Engineering, R. D. Hoak.

May 19. Health Conservation in the Chemical Industries, Dr. F. R. Holden.

STUDENTS IN THE ARMY ENLISTED RESERVE

THE HONORABLE HENRY L. STIMSON, Secretary of War, issued on September 17 the following statement:

Last week I announced that college students who are members of the Army Enlisted Reserve will all or for the most part be called to active duty at the end of the term now beginning, and thereafter, as they reach Selective Service age. This action had been foreseen as a possibility, and in every presentation of the Enlisted Reserve plan to college students and college authorities it was clearly stated that enlisted reservists were subject to call at any time when, in the opinion of the Secretary of War, the exigencies of war demanded it. This statement was made by me personally in the original announcement of the plan on May 14.

In public addresses by War Department officials on the subject of the Enlisted Reserves, the fact that the members were subject to call at any time has been emphasized and repeated. For example, last July 4, Mr. Harvey H. Bundy, Special Assistant to the Secretary of War, addressing a freshman class, said: "There is no commitment that any man may complete his college education." This address containing that statement was distributed to the colleges.

In view of admonitions of this nature, which have been a consistent part of the War Department's Enlisted Reserve policy from the first, and the increased seriousness of the war, the notice that the call to duty would come early in 1943 should not have occasioned great surprise.

However, my statement, together with other recent press reports, has been interpreted in some quarters to mean the end of all higher education for the duration of the war. This is a misapprehension that should be corrected.

The Army is greatly in need of men of specialized training, particularly in physics, chemistry, engineering and medicine. We are equally interested in having adequate numbers of men of such training available to war production industries and the civilian research agencies of the government. Plans are now being worked out for the method of training of those inducted into the Army, but in any event it is hoped that the colleges will maintain their training of students in engineering, medicine and other sciences. In some cases, it will be necessary to expand this training. Occupational Bulletins of the Selective Service System have been issued from time to time which relate to college students in these fields essential to the war effort. I now re-emphasize the fact that where students in these fields and their teachers fall within the classifications for deferment by the provisions of these bulletins they are doing the job their country wants them to do and are performing their full duty in the war effort.

Young men who have joined the Army Enlisted Reserve or who now enlist in it should proceed with their studies until they are called to active duty. When they are called, the Army will utilize for their further training such facilities of its own as it may have or of the colleges as it deems best to meet military requirements as they then exist. The intervening time will afford a period of adjustment and for the formulation of plans for such additional specific training as seems indicated.

These plans, which will probably include a modification of the college ROTC courses, are now under study. When they are completed, the committee of educators appointed by the American Council on Education will be fully informed, and consulted as to the details of their application.

STANDARDS DIVISION OF THE OFFICE OF PRICE ADMINISTRATION

THE newly created Standards Division of the Office of Price Administration, of which Dexter M. Keezer is deputy administrator and acting director, was organized for the purpose of incorporating quality definitions in price, rent and rationing regulations. The new division will have seven sections as follows: Food and Drugs (which also will handle paints and chemicals for the present); Textiles, Leather and Apparel; Consumer Durable Goods; Home Furnishings; Lumber and Building Materials; Agricultural and Industrial Machinery; and Rubber and Rubber Products. Sections to handle fuel and petroleum products; chemicals and paints; transportation equip-

ment; paper, paper products and containers; and metals and metal products, as well as a commodity testing branch, are being organized.

Culver S. Ladd, for many years state food commissioner and chemist of North Dakota, is chief of the Food and Drugs Section. The head of the Textiles, Leather and Apparel Section is H. S. Schenker, of Philadelphia, whose entire business career has been devoted to textile qualities. Earl A. Graham, senior engineer of the engineering firm of Sanderson and Porter of New York, has been placed at the head of the Consumer Durable Goods Section. Erwin G. Adelberger, interior architect and designer, of Cleveland, Ohio, is head of the Home Furnishings Section. Elroy A. Ledwith, architect, who became associated with the defense program in September, 1939, as consultant on housing standards to the National Defense Advisory Commission, is chairman of the Lumber and Building Materials Section. H. Seymour Pringle, assistant professor of agricultural engineering on leave from Cornell University and since 1926 extension specialist in agricultural engineering at the New York State College of Agriculture, has been made head of the Agricultural and Industrial Machinery Section. The Rubber and Rubber Products Section has as its acting head Theodore M. Miller, of Baltimore, consulting chemist. M. L. Egert is the administrative officer of the division.

APPOINTMENTS AND RESIGNATIONS AT FIELD MUSEUM, CHICAGO

Dr. Fay-Cooper Cole, chairman of the department of anthropology of the University of Chicago, has been appointed research associate in Malayan ethnology at Field Museum of Natural History. While his principal work will continue to be at the university, he will serve in a consultative capacity with other members of the museum staff. Dr. Paul S. Martin, chief curator of anthropology, has been appointed research associate (with the rank of full professor) in the department of anthropology of the university. Although continuing his work at Field Museum, Dr. Martin will from time to time give special lectures for classes at the university, and later will give a special course in museology or the technical operations of a museum. These appointments are in furtherance of a plan for closer cooperation that has been adopted by the university and the museum.

The appointment was also announced of Dr. Albert A. Dahlberg, formerly head of the dental clinics at Billings Hospital and now a Chicago practicing dentist, as research associate in paleontology.

Elmer S. Riggs retired on September 24 from active duty as curator of paleontology. He has been associated with the museum continuously since 1898. He will take up his residence in Lawrence, Kansas. Except for a year as museum assistant at the University of Kansas, from which he was graduated, Mr. Riggs has spent his working career as a member of the staff of the museum, going there shortly after he had completed his post-graduate work at Princeton University. During this period he has conducted sixteen important fossil-hunting expeditions—twelve in the western United States, two in Canada and two in Argentina and Bolivia, spending a full four years in the last-named countries.

He is succeeded as acting curator in charge of the division by Bryan Patterson, a member of the museum staff since 1926 and assistant curator of paleontology since 1935.

OFFICERS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Harold V. Coes, vice-president of Ford, Bacon and Davis, Inc., New York, according to an announcement made by C. E. Davies, secretary of the society, has been elected by a letter ballot of the 16,250 members of the American Society of Mechanical Engineers to be president of the society during 1943.

Vice-presidents elected at the same time to serve two-year terms on the council were Joseph W. Eshelman, president, Eshelman and Potter, Birmingham, Ala.; Thomas E. Purcell, general superintendent of power stations of the Duquesne Light Company, Pittsburgh, Pa.; Guy T. Shoemaker, vice-president, Kansas City Light and Power Company, Kansas City, Mo.; Walter J. Wohlenberg, professor of mechanical engineering, Yale University.

Managers of the society elected to serve on the council for three-year terms include Roscoe W. Morton, professor of mechanical engineering and head of the department of the University of Tennessee; Alexander R. Stevenson, Jr., staff assistant to the vice-president, General Electric Company, Schenectady, N. Y.; and Albert E. White, director of engineering research at the University of Michigan.

The new officers will be installed during the sixty-third annual meeting of the society to be held in New York, N. Y., at the Hotel Astor, from November 30 to December 4.

SCIENTIFIC NOTES AND NEWS

Dr. Charles Frederick Burgess, president of the C. F. Burgess Laboratories, Inc., New York City, has been awarded the Edward Goodrich Acheson Medal and $1,000 Prize by The Electrochemical Society.

THE honorary degree of doctor of letters was conferred on September 24 by Colgate University upon Dr. George D. Stoddard, formerly dean of the Graduate College and director of the Child Welfare Research Station at the State University of Iowa, now Commissioner of Education of the State of New York.

Nature reports that the medical faculty of the University of Basle has conferred an honorary doctorate on Professor Eugéne Pittard, rector of the University of Geneva, on the occasion of his seventy-fifth birthday, in recognition of his services to anthropology.

DR. G. S. WHITBY, until recently director of the Chemical Research Laboratory, Department of Scientific and Industrial Research, at Teddington, Middlesex, England, has been appointed professor of rubber chemistry at the University of Akron. For several months he has been connected with the British Raw Materials Mission in the United States.

KARL W. WOODWARD, for twenty-five years professor of forestry and head of the department at the University of New Hampshire and since 1940 consulting forester, has been appointed professor of forestry at the Massachusetts State College during the absence of Professor Robert P. Holdsworth, who is now a captain in the Army. Dr. R. E. Trippensee, professor of wildlife management, has been named acting head of the department.

CLIFFORD O. ANDERSON, of the University of Minnesota, has been appointed assistant professor of mechanical engineering at Iowa State College. Dr. Sara Kalar Merryman has been named assistant professor of hygiene.

DR. FRANK R. BLOOD, of the Haskell Laboratory of Industrial Toxicology of the du Pont Company, has been appointed assistant professor in chemistry at the University of Denver.

DR. JOSEPH T. ROBERTS, assistant professor of medicine and anatomy at the University of Texas Medical Branch, Galveston, has been appointed director of the Experimental Laboratory.

THE *Journal* of the American Medical Association reports that Dr. Alfred Cyril Callister, Salt Lake City, has been appointed dean of the School of Medicine of the University of Utah. Dr. Clay B. Freudenberger, professor of anatomy and formerly acting dean, has been appointed associate dean. Other new appointments include those of Dr. Louis P. Gebhardt, Jr., as associate professor of bacteriology and pathology and of Dr. Robert E. Hoyt as assistant professor. Dr. Gebhardt was formerly acting assistant professor of bacteriology at the School of Medicine, Stanford University, San Francisco, and Dr. Hoyt, instructor in bacteriology in the University of Minnesota Medical School.

DR. CHING CHEH, who has been acting for the past two years as consultant for the Universal Trading Corporation in New York City, has been appointed lecturer in chemistry at Bennington College, Vermont. Helen V. Crouse will lecture on biology.

DR. THOMAS R. WOOD, of the University of Illinois, and Dr. Edward M. Scott, of the University of Minnesota, have been appointed post-doctorate fellows in biochemistry at the University of Pittsburgh.

SIR HAROLD SCOTT retired on August 31 from the directorship of the British Bureau of Hygiene and Tropical Diseases which he has held since 1935. Dr. Charles Wilcocks, assistant director of the bureau, has become acting director.

DR. FRANK W. PARKER, agronomist, E. I. du Pont de Nemours and Company, Wilmington, Del., served during June and July as a consultant on fertilizer problems in the Office of Price Administration. He took part in conducting a series of regional conferences which led to reduction of the number of grades of fertilizer sold in all states, including the adjustment of the nitrogen content of fertilizers to fit the limited supply of chemical nitrogen in prospect for 1943.

DR. CLIFFORD KUH, New Haven, chairman of the committee on industrial health of the Connecticut State Medical Society, has become director of the Bureau of Industrial Health of the California State Department of Health.

FREDERICK W. SULLIVAN, JR., of the Barrett Division of the Allied Chemical and Dye Corporation, where he has been manager of chemical research since 1940, has become technical director of the Institute of Gas Technology, Chicago.

DR. ROBERT M. HEILMAN, of the U. S. Public Health Service, has been appointed head of a newly established division of the Kansas State Board of Health to provide consultant service for the industries of the state.

SARGENT RUSSELL, research assistant at Massachusetts State College since 1940, has resigned to become a member of the staff of the Agricultural Marketing Administration, Washington, D. C.

ACCORDING to *Chemical and Engineering News*, George S. Baldry, formerly connected with the Harvard School of Public Health, has been appointed director of the Division of Industrial Hygiene for the Province of Manitoba.

DR. WILLIAM BEEBE, of the New York Zoological Society, has returned to New York from a seven-month expedition in the jungles of eastern Venezuela.

Members of the expedition staff were George Swanson, staff artist; Jocelyn Crane, who helped in taking 6,000 feet of colored film; Mary VanderPyl, field associate, and Henry Fleming, entomologist. The expedition was sponsored by the Nelson Rockefeller Committee for Inter-American Intellectual Relations and the Standard Oil Company of New Jersey and Venezuela.

The British Medical Research Council, according to *Nature,* has appointed members of its Industrial Health Research Board during the period 1942–45 as follows: The Rt. Hon. the Earl De La Warr, *chairman,* Professor F. C. Bartlett, Brigadier-General A. C. Baylay, Dr. J. C. Bridge, Dr. A. N. Drury, Dr. T. Ferguson, Dr. M. W. Goldblatt, Dr. A. Bradford Hill, Dr. Donald Hunter, Professor Esther Killick, Air Vice-marshal Sir David Munro and J. L. Smyth. Professor A. W. M. Ellis, director of research in industrial medicine under the council, will also attend all meetings. Dr. R. S. F. Schilling, a medical inspector of factories, has been seconded to the service of the Council by the Ministry of Labor to act as secretary of the board. The terms of reference of the board have recently been revised and are now as follows: "To advise and assist the Medical Research Council in promoting scientific investigations into problems of health among workers, including occupational and environmental factors in the causation of ill-health and disease, and the relation of methods and conditions of work to the functions and efficiency of body and mind, and in making known such results of these researches as are capable of useful application to practical needs."

The *Journal* of the American Medical Association reports that "Public Health in New York City: Retrospect and Prospect" will be the subject of the first meeting on November 4 of the fall and winter series of the section on historical and cultural medicine of the New York Academy of Medicine. The meeting will be sponsored jointly by the historical section and the committee on public health relations. Topics to be discussed include "The Story of the Public and Voluntary Health Agencies" and "Glimpses into the Future." The following program has been announced for meetings of the historical section, which are held bi-monthly: Drs. Henry E. Sigerist and Arturo Castiglioni will speak on "Vesalius" on January 13, and Dr. Edward Rosen on "Copernicus," on March 10.

The Rochester Academy of Medicine will open its series of autumn lectures on October 6, when Dr. Oswald H. Robertson, professor of medicine of the School of Medicine of the University of Chicago, will speak on "Air-borne Infections." Dr. Roy G. Hoskins, Boston, will lecture on November 3 on Endocrinology of To-day," and in December

Fred W. Stewart, New York, will discu
of Diet and Diet Deficiencies on the
Cancer."

The forty-seventh annual meeting of
Academy of Ophthalmology and Otolaryn
be held at the Palmer House, Chicago, from
11 to 14, under the presidency of Dr. Ralph I
of Brooklyn.

The council of the Mycological Society of
has cancelled the annual meeting which it was
to hold in New York on December 28, 29 and

The Department of Chemistry of the Univ
Pittsburgh plans to offer free evening course
training of individuals in chemistry for war in
The purpose of these courses is to prepare
and women to replace those who have ent
armed forces and to train individuals alr
ployed in industry for more advanced chen
vice. The courses planned include introduc
advanced metallurgical analysis; microsco
ing of industrial materials; electrical and
struments for analytical control; practical
ing and control; food and water inspectio
tical vitamin assaying; industrial quantitativ
analysis. An elementary course on chemic
mentals for war workers is also planned
individuals for the more advanced practi
which are listed above. A descriptive b
courses may be obtained by writing to Dr
Spencer, regional coordinator of engineerin
and management, war-training courses, Pen
College for Women, Pittsburgh, Pa. Fall c
begin on October 12, and registration will
during the preceding week.

Acting on the suggestions made by G
and military officials at the Institute on
and the War recently held in Washington
York University College of Arts and Pure
University Heights inaugurated an optiona
academic program beginning on Septem
train undergraduates for active particip
war effort. The special curriculum in
eral physics; trigonometry and college
preparation and interpretation of milit
military geology; hygiene and sanita
Spanish, military German or scientific
glish composition emphasizing clarity
of expression; a course in speech which
the methodology of command and proficie
exposition, and the basic course in milita
and tactics offered under the Army's Reser
Training Corps. The curriculum is de
those students who are not preparing f
try or other fields heret
pations.

t *Museum News,* Miss Caroline Hazard, resident of the Santa Barbara Museum of istory, has given the museum an additional property and endowment that will cover up the new gift and perpetuate her annual sub-n to the museum's funds. The land is across et from the museum and will be used for a e for the director and for laboratories and oms. It consists of ten lots, approximately t square fronting on Mission Canyon Road. a California redwood house on the property.

Times, London, states that at a meeting on er 8 of the British Parliamentary and c Committee, the recent appointment of ll-time scientific advisers to the Ministry of on was considered and the following resolu-passed: "This committee, while welcoming intment of three full-time scientific advisers aff of the Ministry of Production in so far as it establishes the nucleus of a central scientific and technical board, regrets that their field of activity is apparently to be limited to the sphere of production and does not include the scientific and technical activities of the service departments or the other ministries outside the strict field of production. An extension of its functions is needed to ensure that all scientific considerations are coordinated and given full weight over the whole field of the national effort. The committee considers, therefore, that in order to cover this wider field, scientific advisers should have direct access to the War Cabinet and that accordingly the Lord Privy Seal should exercise his supervisory functions over the new body directly on behalf of the War Cabinet." It was reported that 126 members have now added their names to the motion on the Order Paper, which suggests that "present circumstances require the early establishment of a whole-time Central Scientific and Technical Board to coordinate research and developments in relation to the war effort."

DISCUSSION

ICAL ORIENTATION OF POWDERY LDEW CONIDIA DURING FALL

YNAMIC theory[1] indicates that flattened or objects fall with the surface of greatest normal to the direction of motion. From observations of the fall of spores of Basidio-nd inert objects Buller[2] confirmed this and general principle that "Any homogeneous body falling in still air tends to orientate uch a way as to present the maximum amount ce in the direction of the line of fall and thus lowly as possible." The fall of powdery onidia in a vertical position and in apparent ent with the above-stated principle is there-terest.

of *Erysiphe graminis* D.C. grown on barley he greenhouse were mostly used, but limited s of *Erysiphe polygoni* D.C. indicate that ry mildews may behave in a similar man-of *E. graminis* are one-celled, ellipsoidal, 13 × 32 microns, with smooth walls, do during several hours of drying, have a nucleus and fall at approximately 1.2 cm d in air. They are therefore much larger, in several other important respects from spores studied by Buller. When caught on s under field or greenhouse conditions most e in a horizontal position with respect to the surface of the slide. However, when caught on glass slides after falling through a glass tube, many conidia are vertical on the slides, and the vertical conidia have fallen at a faster rate than the horizontal conidia. Many of the conidia also fell in a vertical position when suspended in water in a glass tube.

To determine whether the conidia actually fall in a vertical position in air or if the vertical orientation on the slides is an end effect, they were observed and photographed during fall in a glass tube with inside dimensions of 77 × 0.7 cm by means of a horizontal microscope. Dark-field illumination was obtained from a commercial adaptation of the Edgerton flash apparatus.[3] With intermittent flashes (30 times a second) and with a magnification of about one hundred diameters, it was easily possible to determine the orientation of every spore in focus during fall. Of 403 conidia clearly observed, 204 were vertical and 199 were horizontal. An average of two spore images per photograph was obtained when each frame was exposed with 50 microsecond flashes about ten times during a spore fall period. Of 65 single conidia photographed during fall, 34 were vertical and 31 horizontal. In the direct observations and in the photographs all conidia in focus were readily classified as vertical or horizontal and no conidia with intermediate orientation were found, indicating that the falling spores assume one or the other of these two apparently stable positions. With the same tube and with other conditions similar, but catching the conidia on slides, 307 out of 600 were classified as vertical and as horizontal. On the slides some conidia were

mson and P. G. Tait. "Treatise on Natural Article 338, 1867, Clarer

d Buller, "Rese- ans, Green and

leaning and were difficult to classify as vertical or horizontal. The similarity in the data from these three methods would indicate that for most purposes observation of position after fall is a fairly reliable index of position during fall, and that many powdery mildew conidia actually fall with their long axes in a vertical position. Reduction of convection currents is probably an important function of the tube in causing a high percentage of vertical orientation of the conidia and in one test using a narrower tube than the above, all the conidia were found in a vertical position.

Possible explanations for vertical orientation of falling objects are displacement of the center of gravity, rotation about the axis of symmetry and lateral friction due to close approach to the wall of the enclosing container. It has not been determined to what extent any of these could apply to mildew conidia but the writers believe that slight and not clearly observed displacement of the nucleus and vacuoles from a symmetrical arrangement within the spore might account for its vertical orientation under the conditions of the confined air of the small glass tubes.

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THE REQUIREMENTS OF PARASITES FOR MORE THAN HOSTS

The introduction from abroad of beneficial parasites for the control of injurious insect pests may attain even greater success if *all* factors essential to the optimum development of the parasite are studied. For too long the entomologist has centered his attention on the beneficial parasitic stage of the parasite, often failing to appreciate the equal importance of the remainder of its life-history.

Some parasites attack their host in all their active stages, as in the case of the Australian lady-beetle, *Rodolia* (*Novius*) *cardinalis*, which feeds as both larva and adult on the cottony cushion scale, *Icerya purchasi*. Any climatic conditions suitable to the host are equally favorable to its specific predator, with no additional factors necessary, and to this is largely due its outstanding success when introduced originally into California, and later in every other country where the cottony cushion scale has appeared.

This is really the very simplest type of parasite introduction, and the comparative ease with which its success was attained gives little indication of the complications attending that of other kinds of parasites. Most of these attack their insect host either as a larva or as an adult, but not as both, and require some additional factor for survival in their non-para[sitic] stage. No organism can survive in a new environ[ment] where any individual factor essential to its exi[stence] is lacking. It is the neglect of this princi[ple, which] may be considered almost a biological axio[m, that in] many cases has prevented other parasites fr[om becom]ing equally effective in the control of thei[r] injurious host. The following examples, [from the] personal experience of the writer, have a mor[e] local application.

The successful introduction into Puerto Ric[o from] Brazil of a large wasp, *Larra americana* Sa[ussure], which is parasitic in its larval stage on a mole [cricket,] the Puerto Rican "changa," *Scapteriscus* [*vicinus*] Scudder, apparently depended on the pres[ence in] Puerto Rico of two weeds, locally known as ["...]cillo," *Borreria verticillata* and *Hyptis atr[orubens]* from the flowers of which only do the wasp[s obtain] nectar. Where these weeds were continuous[ly pres]ent in abundance in Puerto Rico, *Larra* becam[e estab]lished; where they were scarce or absent, ever[though] changas were present in abundance, the wasp [failed] to survive. It is possible that some other mi[nor fac]tors may in part have been responsible, but [we are] not aware of them, and the experiment seems [to work] as well as one can hope in introductions of t[his kind].

Instances where there is no successful intr[oduction] but only a series of unexplained f[ailures are] more numerous, and of these only [one] need be cited. Repeated attempts [to introduce the] Scarabaeid dung-beetle, *Canthon vi*[...] [from] Hispaniola in Puerto Rico were mad[e ... and] again more recently. The beetles thriv[...] and hundreds of the progeny of th[...] brought from across the Mona Passa[ge ...] released in Puerto Rican environments [that] appear to be identical with those in Hisp[aniola, but] not one has since been found alive in al[...] following. The life-history of these scarab[s is appar]ently so simple that we can not see th[at anything] essential is lacking in Puerto Rico that i[s present in] their country of origin, but it must be s[o, or ...] how explain their failure to survive.

More instructive are instances of ab[...] effective parasites which fail to become [...] where. Throughout the world, white gr[ubs are at]tacked by wasps of the genus *Tiphia*, whi[ch ...] an important factor in control. In Puerto [Rico, the] endemic white grubs became very numero[us and] the major pest of all agricultural crops. *Tiphia* wasps do exist, but are so scar[ce ...] enough specimens have been collected so t[hat ...]ists can be sure of their specific identit[y. In His]paniola, *Tiphia* is abundant, and along [...] often collected feeding on the sweet secre[...]

s and whiteflies. Most of the collections of a in Puerto Rico were made under similar con-s, but in Haiti *Tiphia* is much more often seen g the flowers of wild parsley, *Pastinaca* t the lower elevations in Puerto Rico, wild oes not attain maturity, and even in the s must be planted and cared for if one is to ontinuous supply of flowers. At Kenscoff ewhere in Haiti, it is a weed that no amount ivation seems to discourage. With wild parsley present in abundance at all seasons of the *'iphia* wasps thrive in Haiti, yet barely manage ive in Puerto Rico, feeding on the excretions insects. The presence or absence of this one important but admittedly not absolutely vital non-parasitic stage of their major parasite, tly determined the relative abundance of rubs in these two countries.

offee leaf-miner, *Leucoptera coffeella,* appears esent everywhere that Arabian coffee grows, numerous minute wasp parasites, generally minor importance in its control. On the f Guadeloupe, French West Indies, Mr. F. nd a Braconid parasite, later named *Mirax* by Mr. C. F. W. Muesebeck, which attacks r cent. of all the leaf-miner cater-ed into Puerto Rico, it has become arely can one find more than a frac-t. of parasitization. What factor, ee groves of Guadeloupe, is so scarce roves that this parasite, so effective attain a similar fortunate destiny in

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MPLETE UTILIZATION OF SCIEN-CALLY TRAINED PERSONNEL

cent communication[1] on "Wartime Scien-wer Production" Professor Nicholas deals ase of a problem which has caused, as he growing demand for complete utilization ally trained personnel." Scientific teach-esigned to train new personnel in fields s exist or are imminent furthers the nd should therefore be considered as an duty, as well as an essential war job. everal other ways through which existing ortages in the various fields of physics eviated. There are many workers in the hemical and geological fields who have the s either for teaching or for war research nd who are not as yet doing war work personnel could also b d in ranks of the refugee scientists who are barred from war research because they are non-citizens. Many high-school science teachers are well qualified to teach college courses. In addition, a system for exchange of teaching personnel, such as is already being used by some institutions, could make more teachers available by increasing the efficiency of their utilization.

The above suggestions supplement Professor Nicholas's suggestion of a "personal inventory" with the proposal that the National Roster, or another qualified body, make an inventory of various groups of people who are available to fill the deficit in teaching and research personnel in those fields where shortages exist or are imminent. But it is in relatively few fields that the needs of war research have thus far made a serious drain on scientific manpower. In the field of biology, including the medical and agricultural sciences, and in chemistry mobilization is far from complete. It is chiefly this fact which has caused "the growing demand for complete utilization of scientifically trained personnel," and it was with this phase of the problem that an earlier communication from the American Association of Scientific Workers was concerned. Since the publication of this communication,[2] the AAScW has sent a memorandum (July 30) to the National Academy of Sciences and a letter (Aug. 27) to Dr. Vannevar Bush, the director of OSRD, containing recommendations for specific actions by these two bodies which would aid the mobilization of scientific personnel.

The bottleneck in the full utilization of scientists in the fields mentioned appears to be the difficulty of converting their peacetime research into activity fruitful to the war effort.[3] Many of the war problems in these fields are not obvious to the civilian scientist. Many scientists are therefore awaiting the time when the national scientific authorities will call upon them for specific work. They do not often realize the magnitude of the task which is being done so well by our scientific authorities and many have become discouraged because of the delay in calling upon them for war work. There is hesitation about formulating research projects independently and a paucity of means by which individual or group initiative can be encouraged and made effective. It is feared that independently formulated projects may duplicate work actively in progress and that such independently initiated projects are not wanted by our scientific authorities. Many scientists do not realize that they can themselves make important pioneering contributions to war problems because of their specialized

[1] 6: 2484, 135–6, August 9

[2] *Ibid.*, 96: 2479, 16, July 3, 1942.

[3] This difficulty is not unique for our country but also exists in Great Britain, as can be seen from various editorials in *Nature* and from reports on this question by olleague, the British Association of Scientific Work- *Nature*, No. 3797, August 8, 1942, pp. 186–8.

knowledge of new techniques and of the latest developments in their own fields.

The general solution to the problem of the utilization of scientists has been well stated by Professor Wilder Penfield,[4] who speaks from his experience as a participant in the Canadian and British war effort. In Professor Penfield's words: "It should be recognized as a principle in a democratic country that the government can not be considered omniscient, or always wise. Leadership must therefore develop spontaneously in every department of our national life. New ideas and new efforts should break out among men in all walks of life, from laborer to industrialist and professor, like an epidemic of influenza."

The American Association of Scientific Workers, through several of its branches, is developing activity to aid scientists in formulating and presenting projects for war research. This small-scale experiment is sufficiently promising that it is being paralleled by other groups. The extension of such activity throughout the country appears desirable and the AAScW has recommended to our national authorities various steps which will encourage and promote the exercise of their creative initiative by our civilian scientists so that new problems and new types of research useful to the war effort may arise on the basis of peacetime skills.

Harry Grundfest,
National Secretary, American Association of Scientific Workers

SCIENTIFIC BOOKS

ORGANIC CHEMISTRY

Organic Reactions. Vol. I. Roger Adams, editor-in-chief; Werner E. Bachmann, Louis F. Fieser, John R. Johnson and H. R. Snyder. Pp. vi + 391. New York: John Wiley and Sons, Inc.; London: Chapman & Hall, Ltd. 1942. Price, $4.00.

This is the first volume of a publication which it is hoped to issue periodically in books of about 12 chapters each, under the general editorship of Dr. Roger Adams, an editorial board and a group of associate editors. The editorial group and the contributors of the individual chapters are all recognized leaders in their chosen fields, on both the experimental and the literary sides. The result, as was to be expected, is an admirable piece of work, constituting an exceptionally valuable contribution to the literature of organic chemistry.

Every investigator, in the prosecution of his experimental laboratory work on synthetic organic chemical problems, draws upon our accumulated knowledge of chemical reactions as stored up for him in texts and reference books. Space limitations prevent the inclusion in such books of adequate discussion of the scope and limitations of these reactions, of the conditions determining maximum yields or of giving specific illustrative examples of variations in technic. The investigator, therefore, may have to spend a large amount of valuable time in searching the literature for this information. The purpose of the present undertaking is to meet this need, and all organic chemists will be grateful to those who are carrying through this project.

This first volume consists of 12 chapters, each devoted to a single reaction, or a definite phase thereof, as follows: (1) Reformatsky Reaction; (2) Arndt-Eistert Synthesis; (3) Chloromethylation of Aromatic Compounds; (4) Amination of Heterocyclic Bases by Alkali Amides; (5) Bucherer Reaction; (6) Elbs Reaction; (7) Clemmensen Reduction; (8) Perkin Reaction; (9) Acetoacetic Ester Condensation; (10) Mannich Reaction; (11) Fries Reaction; (12) Jacobsen Reaction. These subjects are presented from the preparative view-point, and the authors have had practical personal experience with the processes described. Each chapter begins with a Table of Contents, lists in tables the different compounds to which the reaction has been applied and includes full references to the literature. The book is indispensable to every investigator of synthetic organic chemical problems.

As it is practically impossible, in gathering data of this kind, not to miss some facts of interest buried in unexpected places, one way in which organic chemists can express their appreciation to the authors of this and subsequent volumes is to call their attention to any omissions they may note. Cooperation in this direction, the reviewer is confident, will be both welcome and helpful.

As is always the case with Wiley publications, paper, presswork and binding are admirable.

Organic Syntheses. Vol. 22. An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Lee Irvin Smith, editor-in-chief, with an editorial board and an advisory board. Pp. 114. New York: John Wiley and Sons, Inc.; London: Chapman & Hall, Ltd. 1942. Price, $1.75.

The new volume of this very useful series describes the preparation of the following: Acetobromoglucose;

[4] "Some Problems in Wartime Neurology," *Arch. Neurol. and Psychiat.*, May, 1942.

9-Aminoacridine; 2-Amino-*p*-cymene; *alpha*-Aminodiethylacetic acid; 2-Amino-6-methylbenzothiazole; 3-Amino-2-naphthoic acid; *dl-alpha*-Aminophenylacetic acid; *dl-beta*-Amino-*beta*-phenylpropionic acid; Azobenzene; *o*-Carboxyphenylacetonitrile; 4,4′-Diaminodiphenylsulfone; 2,6-Dimethoxybenzonitrile; 2,3-Dimethylanthraquinone; 2,3-Dimethylbutadiene-1,3; 2,5-Dinitrobenzoic acid; 3,5-Dinitrobenzoic acid; Diphenylacetylene; Diphenyliodonium iodide; *beta*-Gentiobiose octaacetate; *beta-d*-Glucose-1,2,3,4-tetraacetate; Guanidoacetic acid; Homophthalic acid; 2-Hydroxy-1-naphthaldehyde; Imidazole; Iodobenzene dichloride; Iodosobenzene; Iodoxybenzene; Linoleic acid; Linolenic acid; *d*-Mannose; N-Methyl-3,4-dihydroxyphenylalanine; 2-Methylindole; Phenyl azide, 2-Phenylindole.

As usual, these preparations have been checked by other chemists in addition to those who sent them in, and are accompanied by pertinent explanatory notes and numerous references to the literature. It is noteworthy that the contributors are not limited to our own country, but include also chemists from Canada, Australia, South America and other lands. The cumulative subject index covers Volumes 20, 21 and 22.

An Outline of Organic Nitrogen Compounds. By ED. F. DEGERING, CARL BORDENCA and B. H. GWYNN, with the cooperation of 21 collaborators and many graduate students. Third edition (previous editions 1938 and 1940). 381 pp. Planographed by John S. Swift Company, Inc., Cincinnati, Ohio. May, 1942. Price, $6.

THIS is the first planographed edition of the notes which the author has accumulated and digested during ten years of lecturing in this field to graduate students. As the title states, the book is intended to be only an outline of the subject, and does not aim to be complete either in its coverage of all classes of organic nitrogen compounds or in the details supplied for those classes which are included. So far as the reviewer is aware, it is the only book available which deals with the subject in just this way, and should be very helpful to students, research workers and specialists. Although presented only in outline, briefly, compactly and concisely, the information supplied is very considerable and clearly intelligible.

The arrangement of the subject-matter is, on the whole, logical, beginning with General Concepts, the Fixation of Atmospheric Nitrogen and the Ammonia System of Compounds, then taking up nitro, nitroso, oximino, amino, etc., derivatives, aliphatic and aromatic alkaloids and nitrogen heterocycles, etc., although the reviewer might raise the question whether the Isomerism of the Organic Nitrogen Compounds, instead of being the last chapter in the book, might not better appear much earlier. A separate chapter on Explosives is timely and instructive. Bibliographies and references to the literature are numerous and add greatly to the value of the work. Both author and subject indexes are provided. The book is cordially recommended.

Organic Chemistry. By REYNOLD C. FUSON and H. R. SNYDER. 506 pp. New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd. 1942. Price, $3.50.

As the authors state in the preface, this book aims to cover the ground required of students in the courses known as Chem. 34 and Chem. 36, which together cover the first year's work in organic chemistry at the University of Illinois, where they have been given for many years.

Chem. 34, represented by Part I, consisting of Chapters I to XVIII inclusive, is an initial course. It gives the student a bird'e-eye view of the general field of organic chemistry and familiarizes him with the principal classes of organic compounds.

Chem. 36, as set forth in Part II, Chapters XIX to XXXIV inclusive, likewise covers the general field of organic chemistry, but with more emphasis upon details and especially upon the use of standard reactions in synthesis. This Part II has been found useful by graduate students as a survey and review course and in preparation for Ph.D. examinations.

Manifestly, this method of presentation involves a certain amount of repetition but, in the opinion of the authors, this is distinctly advantageous.

At the end of most of the chapters, "Problems and Suggested Readings" are given, and at the close of the book, in addition to the index, Appendix A discusses "Nomenclature and Pronunciation," and Appendix B gives an extensive list of additional "Problems and Questions for Review."

A praiseworthy feature of Part II, in emphasizing important reactions, is the association therewith of the names of the chemists by whom they were discovered or developed. The student thus becomes acquainted with some of the builders of the vast edifice of organic chemistry. Another useful feature is the attention given to the industrial applications of the experimental facts recorded.

The book constitutes an admirable first-year course, lucidly and logically presented, up to date, and is a good illustration of the excellent instruction given in this field at the University of Illinois. Paper, presswork and binding are first-class.

MARSTON TAYLOR BOGERT

SPECIAL ARTICLES

BIOTIN DEFICIENCY AND OTHER CHANGES IN RATS GIVEN SULFANILYLGUANIDINE OR SUCCINYL SULFATHIAZOLE IN PURIFIED DIETS

THERE is general agreement[1, 2, 3, 4] that sulfaguanidine (sulfanilylguanidine), added to a purified diet, reduces the growth rate of young rats. Similar results have been reported[4, 5] for sulfasuxidine (succinyl sulfathiazole). It has been suggested[1, 5] that the reduced rate of growth might be explained on the basis of suppression by the drug of intestinal synthesis of essential growth factors. It has been further suggested[4] that these sulfonamide drugs might exert a part of their effect by interference with the action, in the animal body, of one or more essential enzyme systems. If sulfaguanidine and sulfasuxidine act through either or both of these mechanisms, then it should be possible to produce characteristic deficiency syndromes, the development of which might be prevented, individually, by the use of small amounts of pure substances or concentrates.

In this laboratory, we have observed the following changes in rats given sulfaguanidine or sulfasuxidine in purified diets. First, hyaline sclerosis and calcification of blood vessels[6]; second, agranulocytosis, leukopenia, bone marrow aplasia and, occasionally, anemia[4]; third, hyalinization, necrosis and calcification of voluntary muscle[7]; and fourth, a dermatitis which can be prevented or successfully treated with biotin. We have also observed necrosis of heart muscle, hemorrhage into various organs and subcutaneous tissues, and liver damage.

In our work with the sulfonamide drugs we have to date employed variations of a single basic diet. This basal diet consists of glucose ("Cerelose") 73 per cent., leached and alcohol extracted casein 18 per cent., cod liver oil 2 per cent., cottonseed oil (Wesson oil) 3 per cent. and salt mixture 4 per cent. The drug at a level of 1 per cent. has been included at the expense of an equivalent amount of glucose. Each rat has been given a daily supplement of 100 micrograms of thiamine, 200 micrograms of riboflavin, 100 micrograms of pyridoxine, 200 micrograms of calcium pantothenate, 1 mg of niacin and 10 mg of choline chloride.

Thirty rats receiving sulfaguanidine and 10 receiving sulfasuxidine have been kept on this régime until their deaths. Twenty additional rats receiving one or the other of these drugs have been given a daily supplementary feeding of 0.05 cc of an impure biotin concentrate,[8] beginning after growth of these animals had ceased; 35 others have been given, similarly, 40 to 100 mg of a liver extract[9] daily.

Of the 40 rats given neither biotin concentrate nor liver extract, only 2 have survived longer than two months. Examination of the blood of 22 of these rats shortly before death revealed an agranulocytosis and a leukopenia and, less frequently, an anemia.[4] Histological examination revealed some degree of bone-marrow aplasia in 16 of 18 marrows examined,[4] a hyalinization, necrosis or calcification of voluntary muscle in 12 of 15 rats examined for this condition,[7] but blood vessel changes in only 5 of the 29 of these rats examined to date.[6] Any degree of biotin deficiency present in these animals was difficult to diagnose.

The use of the biotin concentrate has proved to be of value in the routine development of the blood vessel changes. Of the 20 rats given 0.05 cc portions of this concentrate, 11 have survived for 2 months or longer and 3 have lived for more than 3 months; 13 of these 20 animals have been examined histologically to date; 11 of these 13 have shown hypocellularity of bone marrow, 12 have shown muscle hyalinization and necrosis, and 10 have shown calcification of blood vessels.

The use of the liver extracts has been of particular value in the development, in a mild form, of the characteristic dermatitis of biotin deficiency. No attempt has been made to determine the span of life of these animals, but of the 35 rats used in this phase of the work, 33 have been kept on experiment for 3 months or longer. The dermatitis has developed very slowly but has been noted in 24 of the 35 animals. It is similar in appearance to that produced by raw egg white but does not attain the same severity.[10] Remission of symptoms has occurred in all 10 animals which were given crystalline biotin[11] orally or parenterally in daily doses of 0.5 to 10 micrograms for 14 days.

[1] S. Black, J. M. McKibbin and C. A. Elvehjem, *Proc. Soc. Exp. Biol. and Med.*, 47: 308, 1941.

[2] J. B. Mackenzie, C. G. Mackenzie and E. V. McCollum, SCIENCE, 94: 518, 1941.

[3] W. J. Dann, *Jour. Biol. Chem.*, 141: 803, 1941.

[4] S. S. Spicer, F. S. Daft, W. H. Sebrell and L. L. Ashburn, Prevention and Treatment of Agranulocytosis and Leukopenia in Rats Given Sulfaguanidine or Succinyl Sulfathiazole in Purified Diets, *Pub. Health Rep.* (in press).

[5] A. D. Welch, *Federation Proceedings*, Part II, Fed. of Amer. Soc. for Exper. Biol., Vol. 1, p. 171, March 16, 1942.

[6] F. S. Daft, L. L. Ashburn, S. S. Spicer and W. H. Sebrell, *Pub. Health Rep.*, 57: 217, 1942.

[7] F. S. Daft, L. L. Ashburn and W. H. Sebrell. Unpublished results.

[8] S.M.A. No. 1000.

[9] Eli Lilly's No. 343 or Lederle's 80 per cent. alcohol insoluble.

[10] The results of microbiological assays indicate the following approximate figures for the biotin content of these liver extracts: Lilly's No. 343 1.5 micrograms per gram; Lederle's 80 per cent. alcohol insoluble 0.06 micrograms per gram. We are indebted to Dr. Roy Hertz for these assays.

[11] Supplied through the courtesy of Dr. Hans Molitor, Merck Therapeutic Institute.

SUMMARY

The following pathological changes have been observed in rats given sulfaguanidine or sulfasuxidine in purified diets.

1. A granulocytopenia, leukopenia, hypocellularity of bone marrow and, occasionally, an anemia.

2. Hyalinization, necrosis and calcification of voluntary muscle.

3. Hyaline sclerosis and calcification of blood vessels.

4. A dermatitis which can be prevented or successfully treated with crystalline biotin.

We have also observed necrosis of heart muscle, hemorrhage into various organs and subcutaneous tissues, and liver damage.

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ATYPICAL RESPONSE OF THE RABBIT TO DESOXYCORTICOSTERONE ACETATE

WE have found[1,2] that administration of desoxycorticosterone acetate, progesterone, alpha-estradiol benzoate, testosterone proprionate and diethylstilbestrol to dogs results in a marked increase in the rate of entrance of Na and Cl into 5.5 per cent. dextrose solution introduced into the peritoneal cavity. No such effect was noted in rabbits following administration of desoxycorticosterone acetate, progesterone and diethylstilbestrol.[2] Certain additional findings are of interest in this connection.

Injection of 2.5 mg of DOCA daily for three days in two rabbits had no significant influence upon the urinary excretion of water or Cl during the experimental period. Two rabbits (2.0 and 1.8 kg) received 2.5 mg of DOCA daily for three months, the animals being weighed and the blood-pressure determined[3] bi-weekly. There was no significant change in weight for six weeks in one animal and eight weeks in the other, with a subsequent increase to a maximum of 47 and 40 per cent., respectively, over the pre-treatment levels at the end of the experimental period. There was no significant alteration in blood-pressure and no edema or other evidence of toxic effect of DOCA, as has been reported in the dog.[4] Two pregnant rabbits treated in the same manner showed no significant gain in weight, no edema and no increase in blood-pressure. Both aborted at about four weeks' gestation, one developed marked weakness of the hind limbs after five weeks of treatment and both died after six weeks. The weakness of the hind limbs may have been due to decrease in the serum K concentration; the serum Cl concentration was unaltered in the non-pregnant animals, but no chemical studies were performed in the pregnant rabbits. Dexter and Weiss[5] have reported a similar absence of effect of large doses of DOCA in pregnant and non-pregnant rabbits in experiments of shorter duration.

These observations suggest the existence of a marked species difference in the influence of DOCA and perhaps also progesterone, estradiol, testosterone and other steroid hormones upon water and electrolyte metabolism. This has an important bearing, perhaps, on the use of the rabbit in studies of the relation of these hormones to hypertensive "toxemia" of pregnancy.

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1 A. Cantarow and A. E. Rakoff, *Endocrinology*, 27: 652, 1940.

2 A. E. Rakoff and A. Cantarow, *Endocrinology*, 30: 816, 1942.

3 R. I. Grant and P. Rothschild, *Jour. Physiol.*, 81: 265, 1934.

4 D. Kuhlmann, C. Ragan, J. W. Ferrebee, D. W. Atchley and R. F. Loeb, SCIENCE, 90: 496, 1939.

5 L. Dexter and S. Weiss, "Preeclamptic and Eclamptic Toxemia of Pregnancy." Boston: Little, Brown and Company, 1941.

UNIFORMITIES IN THE CONTENT OF B VITAMINS IN MALIGNANT NEOPLASMS

FOR two years[1] this laboratory has been interested in the possibility that cancer tissues might show peculiarities in vitamin distribution, characteristic of this type of growth. We have now completed an extensive series of determinations of eight B vitamins not only on various types of human, rat and mouse cancer material but also upon normal tissues from these same animals. This material is now in press.[2]

By analysis of the values obtained, highly interesting and important uniformities are observed which we wish to set forth briefly here. We shall use the term "vitamin uniformity" to designate the similarity of vitamin content in a group of tissues. For example, if in a number of samples of muscle tissue pantothenic acid had a mean level of 5 γ per gram with a standard deviation of 1, then $1/5 \times 100$, or 20, would equal the average deviation from the mean in per cent., or, to express the relationship in the opposite manner, there would be an average degree of uniformity in pantothenic acid content of 80 per cent. The average of the "vitamin uniformities" in a series of tissues calculated for the individual vitamins is designated the "Total B Vitamin Uniformity."

1 R. J. Williams, SCIENCE, 92: 579, 1940.

2 University of Texas Publication 4237, 1942.

It has been found (Table I) that normal tissues of the same type but taken from separate animals, such as myocardium from different hearts, have a relatively high "total B vitamin uniformity" (70 per cent. or more), while normal tissues which differ from each other in structure and function have a relatively low degree (less than 30 per cent.) of "total B vitamin uniformity" when compared with each other.

TABLE I

VITAMIN UNIFORMITY IN NORMAL AND CANCER TISSUES

Tissues	"Total B Vitamin Uniformity" in per cent.
Human Tissues	
8 diverse normal tissues	27
Myocardium from three separate hearts*	71
8 diverse cancer tissues	66
Normal mammary, ovarian and renal tissue	11
Mammary, ovarian and renal carcinoma	60
Rat Tissues	
8 diverse normal tissues	30
Myocardium from three separate hearts*	75
5 diverse cancer tissues	63
2 hepatomas	78
2 hepatomas with corresponding adjacent liver tissues	22
Mouse Tissues	
Myocardium from three separate hearts*	76
12 diverse cancer tissues	58
Human, Rat and Mouse Tissues	
Myocardium from three human, three rat and three mouse hearts	61.2
8 human, 5 rat and 9 mouse cancer tissues of diverse origins and sites	58.8

* Individual tissues other than the heart from different specimens (in human, rat and mouse) also show high "total B vitamin uniformity" but are not included in this table.

Examination of the tumor material in this manner disclosed that malignant tumors which differed from each other in tissue of origin, manner of induction and host species tended to have a relatively high "total B vitamin uniformity" when compared with each other.

Since in our observations on normal tissues a relatively high degree of "total B vitamin uniformity" has been found to be associated only with homogeneous and never with heterogeneous groups of tissues, it is concluded that malignant neoplasms of various types and from various animals tend to have similar cellular metabolism, forming in effect a common tissue type.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE DETERMINATION OF BLOOD VOLUME WITH RED BLOOD CELLS CONTAINING RADIOACTIVE PHOSPHORUS (P^{32})[1]

THE red cell, rather than the plasma component of the blood, has several advantages in determining blood volume. First of all, the fluid portion of the blood, because of its physiological connection with tissue, lymph and other fluid spaces, is not so anatomically delimited as that containing red cells. Secondly, changes in capillary permeability affect the plasma much more frequently and markedly than the red cells. Third, the dyes used to measure plasma volume, because of diffusion and adsorption, may themselves behave differently from the plasma they are supposed to measure.

Total red cell volume has been measured by the carbon monoxide method, which, however, has not achieved acceptance for a variety of reasons. More recently, blood volume methods have been described using red cells containing radioactive iron[2] and radioactive phosphorus.[3] Though radioactive iron has a long half-life and remains in the red cells for long periods it has a serious practical disadvantage of emitting such soft radiation that direct measure of the radioactivity of the blood is technically difficult and requires more or less complicated chemical manipulations. On the other hand, radioactive phosphorus, though its half-life is but 14 days, emits energetic beta particles which enables red cells containing it to be measured more easily. Nevertheless, in the phosphorus method described by Hahn and Hevesy[3] chemical extraction of the red cells was necessary; moreover, a large amount of blood (50 cc) was used for the extraction.

In the technic to be described herein, but two cc of blood were used and they were measured directly in the Geiger counter without any chemical manipulation whatever. A donor dog was prepared by the subcutaneous injection of sodium phosphate containing radioactive phosphorus. The dose was 0.4 millicuries (P^{32}) per day for 10 days. After several days the red cells became so intensely radioactive that the blood could be diluted 100 times and yet give a sufficiently high count for accurate measurement. Washing the cells in saline several times and suspending in saline for 24 hours resulted in very little loss of activity. For the determination of blood volume 10 cc or more of the donor dog's blood was heparinized, centrifuged and the plasma (which also contains radioactive phosphorus) removed. The cells were resuspended in

1 Aided by a grant from the Commonwealth Fund.

2 P. F. Hahn, J. F. Ross, W. F. Bale, W. M. Balfour and G. H. Whipple, *Jour. Exp. Med.*, 75: 221, 1942.

3 L. Hahn and G. Hevesy, *Acta Physiol. Scand.*, 1: 3, 1940.

saline and a carefully measured amount (1 cc/Kg) injected into the dog whose blood volume is to be measured. After allowing a variable time for mixing, a sample was removed, its radioactivity measured directly and compared with that of the sample injected. The blood volume was a simple matter of division. To determine red cell and plasma volume, the hematocrit provided the necessary relationship for the calculation.

We determined the radioactivity of the recipient dog's blood at various intervals after the injection in order to determine whether there was a curve of disappearance as there is with the dye method; we found no loss of activity for several hours which was more than long enough for thorough mixing. However, a slight but increasing loss of P_{32} from the red cells was observed thereafter, confirming previous observations of Hahn and Hevesy.[3,4] In this respect radioactive phosphorus presents a disadvantage over radioactive iron which, as already mentioned, remains for a long time within the red cell. On the other hand, for ease and simplicity, the method here described enables a determination to be made on one single sample of blood from the dog to be tested and but two direct determinations of radioactivity on the Geiger counter. Incompatibility of donor and recipient, though rare, will make the test valueless because of hemolysis. Our results confirm those of Hahn *et al.*,[2] in that the blood volume as determined in the above-described method is lower than that obtained by simultaneous determinations with the blue dye (T–1284). Additional details will be described later.

The authors are indebted to Dr. John H. Lawrence for supplying the radioactive sodium phosphate and to Dr. Carl Moore for the Geiger counter used in these experiments.

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[4] L. Hahn and G. Hevesy, *Nature*, 144: 72, 1939.

FREEZING MYRIAPODS FOR PHOTOGRAPHING

PHOTOGRAPHING small myriapods, such as pauropods 1.5 mm in length, presents many difficulties. Distortion especially is pronounced when they are inactivated or killed. The application of anesthetics such as ether, chloroform, chloretone, etc., to immobilize them was not found satisfactory because of ensuing contraction and distortion. Specimens preserved in alcohol or formaldehyde were likewise found to be misshapen.

Slow killing in a sealed moistened cell chamber mounted on a glass slide was tried. By applying heat from a 60-watt bulb at a distance of 6 to 8 inches, the specimens became immobile in a few minutes. This procedure partially solved the problem of getting the desired relaxation but was discontinued when found to be rather erratic.

Finally, quick freezing was tried and found successful. A small glass circular cell was placed on an ordinary glass slide and the bottom covered with thick, black absorbent paper or a mixture of 3 parts plaster of Paris and 1 part powdered animal charcoal. Moisture was added, live specimens placed within, and the cell sealed with a cover slip. The specimens were then exposed to a temperature of $-12°$ C for about 25 minutes which killed them and at the same time preserved a nearly normal appearance.

A fixed focus camera used with a compound microscope was prepared ahead of time. For our set-up it was found satisfactory to use a Bausch and Lomb surface illuminator. When the specimens were ready they were taken from the freezing chamber and immediately photographed. If desirable the cover slip may be removed during exposure and replaced immediately after to prevent drying. Thus, the same specimen may be used more than once. With the light source at our disposal it was found best to keep exposure time ½ second or less, since a longer period tended to curl and dry the specimens. This freezing method should be equally applicable in photographing other small organisms.

MYCHYLE W. JOHNSON
JAMES H. STARLING

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BOOKS RECEIVED

BAKER, EDWARD. *A First Course in Mathematics for Students of Engineering and the Physical Sciences.* Pp. xiii + 295. D. Van Nostrand Company, Inc. $3.00.

COURANT, RICHARD and HERBERT ROBBINS. *What is Mathematics?* Pp. xix + 521. Oxford University Press, New York. $5.00.

COX, JOSEPH F. and LYMAN JACKSON. *Field Crops and Land Uses.* Illustrated. Pp. xiv + 473. John Wiley and Sons, Inc. $3.75.

FREAR, DONALD E. H. *Chemistry of Insecticides and Fungicides.* Illustrated. Pp. viii + 300. D. Van Nostrand Company, Inc. $4.00.

HOSKINS, MARGARET M. and GERRIT VEVELANDER. *Outline of Histology.* Illustrated. Pp. 112. C. V. Mosby Company.

KISER, CLYDE V. *Group Differences in Urban Fertility.* Pp. xii + 284. The Williams and Wilkins Co. $2.50.

KOL, ERZSÉBET. *The Snow and Ice Algae of Alaska.* Illustrated. 6 plates. Pp. 36. Smithsonian Institution.

LANDIS, CARNEY and M. MARJORIE BOLLES. *Personality and Sexuality of the Physically Handicapped Woman.* Pp. xii + 171. Paul B. Hoeber, Inc. $3.00.

WILSON, CHARLES MORROW. *Ambassadors in White.* Illustrated. Pp. x + 372. Henry Holt and Company. $3.50.

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The purpose of this book is to supply a group of problems for use with the course in qualitative chemistry. It is designed to accompany the author's "A Textbook of Elementary Qualitative Analysis," or any other textbook of similar scope. In this edition some rearrangements have been made in the order of treatment, and new problems have been substituted throughout.

Second Edition Published in September **174 pages;** **6 by 9;** **$2.00**

APPLIED NUCLEAR PHYSICS

By ERNEST POLLARD, *Assistant Professor of Physics, Yale University,* and WILLIAM L. DAVIDSON, JR., *Research Physicist, The B. F. Goodrich Company.*

This book offers a descriptive and explanatory account, for class use, of the facts and methods of artificial radioactivity and transmutation, including properties of nuclear radiation, means of detection of nuclear particles, technique of artificial acceleration, energy relationships in reactions, the manufacture and counting of radioactive elements, isotopes, nuclear fission, and kindred subjects.

Ready in October **Approx. 244 pages;** **6 by 9;** **Probable price, $2.75**

SCIENCE NEWS

Science Service, Washington, D. C.

NOVAE

A TEMPORARY star or nova which suddenly flares up in the heavens without warning and then gradually fades, is not quite the cataclysmal event that some theoretical physicists have supposed. This view was expressed by Dr. Dean B. McLaughlin, professor of astronomy at the University of Michigan and secretary of the American Astronomical Society, speaking before a recent meeting of the Rittenhouse Astronomical Society at the Franklin Institute.

The outburst is a surface explosion, Dr. McLaughlin believes, of tremendous proportions to be sure, involving as it does the entire surface, but not necessarily fatal. After "blowing off steam," the star returns to approximately its former state. Its temporary excursion into notoriety produces little change in its normally humdrum life.

Dr. McLaughlin's view is based on a personal examination of all spectra of "novae," or new stars gathered at the University of Michigan Observatory and at the other leading observatories of the United States. It is a good idea, he said, for "one set of eyes, with one set of prejudices" to examine all the observational material.

New stars at maximum light, he explained, are about 50,000 times as bright as the sun, though they are so far distant that they appear like ordinary stars. Before outburst they are about the same real brightness as the sun but are smaller, denser and hotter—a type known as subdwarfs. Increase of light from minimum to maximum takes only a few days, but the decline takes several years. The flare-up must be due to an explosion whose cause is not known. The surface layers expand as a cloud of gas around the star at a speed of hundreds of miles per second. After some months the expelled clouds of gas become visible as a faint nebula around the star. At the end of the decline the star is apparently not changed from its previous condition, and it must be concluded that all the disturbance is superficial.

Altogether about 90 novae have been recorded in our milky way system, and over 100 have been found in the neighboring spiral nebula Andromeda.

ENERGY OF THE SUN

MAN is harnessing the sun to supply power for his home, factories and vehicles. Long a dream, present research indicates that the future world may be powered by energy snatched from a sunbeam. But practical application awaits results of the long-range research program now being conducted.

Many such glimpses of happenings in science are presented in the annual report of the Smithsonian Institution, which has just been issued.

Utilization of scientific advances in post-war reconstruction, however, will require sources of power not dependent on dwindling resources. Energy equal to 21,000,000,000 tons of coal which the sun showers on the surface of our globe every hour, offers fascinating possibilities.

There is one major obstacle to harnessing this power; economics. Power produced, the report indicates, depends directly on the area over which solar energy is gathered. This would need to be large and the cost consequently high. Solution of this problem has been a foremost objective of Smithsonian Institution researches.

Dr. Charles G. Abbot, secretary of the institution, has built highly efficient solar engines which have come close to economic practicability compared with other power-producing systems.

Various possibilities of solar energy are outlined by Dr. H. C. Hottel, of the Massachusetts Institute of Technology, where experiments are also being conducted. Their program calls for exploration of all the possibilities of economic conversion of solar energy into forms useful in industry.

One method would be direct conversion of the sun's rays into electricity. This would be based on the principle of the thermocouple. That is, when two wires of two different elements are joined and the junction is heated, a small part of the heat is converted into electrical energy. Efficiency here depends on the properties of the two materials used. Intensive study is now in progress to learn which metallic compound give the best results.

Another apparatus is operated by photoelectricity—the same principle which operates the exposure meter used by photographers. Here the light strikes a specially prepared metal plate which also results in conversion to electrical energy.

Or perhaps, it is suggested, we can duplicate nature's own method of storing solar energy. Through chlorophyll, the green stuff in leaves, sunlight is stored in growing things. Perhaps millions of years later it is released by the burning of coal or oil. It is hoped that through a thorough understanding of nature's process, we may be able to make synthetic fuels out of easily available chemicals in a few minutes.

Atomic power, discussed by Dr. Ernest O. Lawrence, of the University of California, is also much in the news. Recent progress must be kept secret at this time. But up to about a year ago the status was about that of aviation fifty years ago. That is, the basic principles are known, but practical application awaits the development of a new instrument or technique.

THE CORROSION OF IRON PIPES

BACTERIA have been found responsible for corrosion of iron pipes carrying deep well waters in the Miami Valley, Ohio. These waters contained very little oxygen and practically no other corrosive substances that could be detected by the usual chemical test. Similar trouble with "red water" at Middletown, Ohio, has been cleared up with chlorine treatment which killed the bacteria.

The investigation which lead to this discovery was carried out by Dr. Arba H. Thomas, chief research chemist of the American Rolling Mill Co., of Middletown.

The organism chiefly responsible, Dr. Thomas found, was cocco bacillus, an organism of the anaerobic type. This type requires no oxygen for its life processes. In fact oxygen is poison to it. This type reduces sulphates in the water and liberates hydrogen sulphide which attacks the iron producing the black iron sulphide. This kind of corrosion is therefore very different from that produced by electro-chemical action which results in the red oxide of iron or rust.

Other organisms, the so-called "iron-consuming" bacteria, were also found. These, the crenothrix, spirophyllum and leptothrix, do not actually devour metallic iron, but they do consume dissolved ferrous salts, converting them to the insoluble red ferric hydroxide or a similar substance, producing "red water."

By introducing oxygen into the water, it was found that the rate of corrosion decreased as the quantity of oxygen increased, just the opposite to what would have occurred if oxygen had been the cause. These bacteria, Dr. Thomas said, have long been known to biologists, but their connection with corrosion was only recently suspected. They are not disease producing.

The remedy is to chlorinate the water, or where it is to be used for drinking purposes and the chlorine taste would be objectionable, the chlorine-ammonia or chloramine treatment can be used. This not only kills the bacteria, but removes any deposits that have already been formed on the metal. Ordinary lime-soda softening treatment will kill the less resistant types of bacteria, but not the hardier ones. Also a good coating of a coal-tar base enamel will protect the metal.

OIL FOR THE ALASKA HIGHWAY

AVIATION gasoline and diesel engine oil will soon be flowing through a new pipeline toward the Alaska highway from oil wells and the world's most northern refinery at Fort Norman on the Mackenzie River in Canada 125 miles south of the Arctic Circle. Vast untapped tar sands in northern Alberta are being moned for oil, gasoline, asphalt and coke.

The wells at Fort Norman have been in existence since 1921. They were little used, however, in fact were capped until 1930, when discovery of radium on Great Bear Lake shores brought aerial prospectors in vast numbers. Shortly after the outbreak of war a new refinery was built at Fort Norman producing aviation gasoline and diesel engine oil. This plant, according to Munitions and Supply Minister C. D. Howe, has now been expanded, and will probably be in use for a longer period than just during the summer, as it has since installation.

"An intensive study of the tar sands is under way at present time," stated Minister Howe, in Parliament. "To-day we think of that area as a source of immediate oil production, provided the problems connested with its development can be solved rapidly and with some degree of certainty. Arrangements have been made to develop further the wells on the lower Mackenzie River at Fort Norman. Additional wells are being drilled, the refinery capacity is being increased, and a short pipeline is being installed to bring the oil across to the location of the Alaska highway."

From the sands along the Athabasca River in northern Alberta, Indians have since time immemorial used pitch to caulk their canoes. The first white men to come into the area in 1788 found the oil sands to stretch for miles, and in some places found oil bubbling to the surface. Since the settlement of Alberta many attempts have been made to obtain oil from these oil-rich sands. Last year the first successful commercial extraction plant began operations to obtain lubricating oil and gasoline from the tar sands.

The oil sands along the Athabasca River are considered by oil authorities to be one of the largest oil reservoirs in the world. According to the geological estimates of the Canadian Government, the oil sands contain at least a hundred billion barrels of oil. But it will be a big job to get it out.

Because of transportation difficulties and because no suitable extraction system had been devised, the oil sands remained unworked. These oil-saturated sands range in thickness from a few feet to 225 feet, and in oil content up to 25 per cent. by weight. They cover an area estimated at from 10,000 to 50,000 square miles. A large part of the area is overlain with shale and sandstone up to a maximum depth of 1,800 feet, and underground methods of mining are not considered workable. The oil will not flow into wells fast enough to be pumped commercially. But erosion on the Athabasca River and its tributaries has left benches that can be mined by open pit methods.

The bituminous sands have produced a high quality of asphalt which has been used for paving fairly extensively in the past, and it is expected to be used for this purpose also on the Canada-Alaska Highway now being built. They stretch for miles on each side of the river, covering roughly an area 115 miles north and south, and 55 miles east and west. The sands lie about 600 miles north of the international boundary in an area which can be developed the year round.

The extracting plant which went into operation last year on a small scale took 11 years of research by American engineers to develop. The sands go through a separation process, then to a refinery where the crude oil is turned into gasoline, diesel fuels, fuel oils, asphalt and coke. It is thought that synthetic rubber may also be developed from these bituminous sands after they pass through the separation process.—JAMES MONTAGNES.

ITEMS

A CONSIDERABLE sector of the vast plastics industry is founded on coal, Dr. R. L. Wakeman, of the Mellon Institute, and Dr. B. H. Weil, of the Gulf Research and Development Company pointed out. Some of the best known and most useful plastics are formed in part of phenol, and phenol is a coal product. The other half is often formaldehyde, made from water gas, which in turn comes from coal or coke. These plastics play their part

in war as gunstocks, mortar projectile noses, bulletproof transparent noses and turrets of planes, instrument panels and handles of a hundred shapes and kinds. In peaceful life they follow the citizen from the plastic toys put into his cradle to the molded plastic coffin in which he is lowered into his grave.

RESEARCH pays in hard, cold cash, Eugene Ayres of the Gulf Research and Development Company told the meeting of the American Chemical Society recently. He explained a numerical yardstick which he has developed, which gives an estimate of the differences in costs between industrial processes put into operation without waiting for preliminary experimentation and those that are given the benefit of research in laboratory and pilot plant, together with proper patent procedures, before they are strated. If a given industrial problem is carried through all three steps, or research, patent procedures and pilot plant experiments, the total cost of "make-ready" is considerably less than half that involved in rushing into full production without the preliminary steps. How necessary the pilot-plant stage is also shows up in the table. With laboratory research and patent procedure, but omitting pilot plant, the costs were substantially greater than those of complete preparation, though still substantially less than those of no preparation at all. Mr. Ayres cited the case of a company that found it necessary to go into the manufacture of a new chemical in a hurry: "There were no large-scale precedents for this operation, but two good process ideas were offered by the Research Department. Because of the emergency, it was decided to commercialize one idea without any research, while the second idea was carried in orderly fashion through laboratory and pilot plant. Despite the delay occasioned by months of research, the second idea resulted in a smoothly operating plant before the first and at much lower development cost. The first idea was then sent back to the Research Laboratory and a year later superceded the second."—FRANK THONE.

NOT just his brain, but a pilot's teeth as well, may "black out" when he pulls out of a power dive. The suggestion is made by Capt. Herbert J. Lipson, M.C., U.S.A., and Dr. S. G. Weiss, Muskogee, Oklahoma, dentist, in a report in the *Journal* of the American Dental Association. The centrifugal force, which pulls the blood away from the pilot's brain, causing the familiar "black out" symptoms, would also pull the blood out of the pulp of his teeth. The absence of any recoil mechanism in the "hard, unyielding wall of dentin" surrounding the tooth pulp makes it unlikely that recovery from a "black out" in the tooth would be "so efficient or so nearly complete as in the brain." Permanent damage or death of the tooth might result. Extreme cold at high altitudes and the "bends" to which aviators as well as divers are subject might also cause injury of the tooth pulp.

SCIENCE

VOL. 96 | FRIDAY, OCTOBER 9, 1942 | No. 2493

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE RADIO CORPORATION OF AMERICA

THE DEDICATION OF THE LABORATORIES AT PRINCETON, N. J.

THE new RCA Laboratories built by the Radio Corporation of America at Princeton, New Jersey, a modern center of radio and electronic research, were dedicated on September 27.

Lieutenant General James G. Harbord, chairman of the board of Radio Corporation of America, presided and introduced the speakers: Major General Dawson Olmstead, chief signal officer of the Army; Colonel David Sarnoff, U. S. Army Signal Corps, and Otto S. Schairer, vice-president in charge of RCA Laboratories.

General Harbord pointed out that the RCA Laboratories assemble under one roof kindred activities which have hitherto been performed by individuals widely separated by time and space. "The Laboratories give our future scientific work the advantage of collective effort—the advantage in our attack on our problems of delivering a blow with a clenched fist instead of with open fingers. They promise much for the future of the radio industry, now so closely tied in with our war effort. And when the lights are once more turned on in this darkened world, we shall take off from here for a brilliant future of which we can now dream but can not measure."

Ground was broken for the laboratories on August 8, 1941. On November 15 of that year the cornerstone was laid, dedicating the project to increase in the usefulness of radio and electronics to the nation.

A tour of the laboratories reveals their size, magnificence, efficiency and promise. It is not only a radio laboratory, but many laboratories which reveal that modern radio is a science spreading into many fields—electronics, sound-acoustics, chemistry, physics,

mechanics and optics, from which grow many by-products and branches—cathode ray tubes, fluorescent materials, lenses and photography.

The laboratories building is a three-story structure with long corridors into which open 150 laboratory bays. To understand what is behind them, the inspection must begin in the basement. It is the nerve center. Into it, through underground arteries of conduits and pipes, are fed the electric power, gas and water supply. Alongside huge water tanks and air-conditioning apparatus are transformers and vault-enclosed power regulators, while the compressed air and steam are supplied from the heating plant. From two 300-foot wells, 600 gallons of water are pumped in a minute.

All the services of electricity, water and gas flow in conduits on the basement ceiling under the main corridor. There are 104 vertical shafts, which rise from basement to penthouse, with outlets on each floor. From these, wires and pipes carry the vital services to 420 work-benches, each 6 feet long. These unique service shafts are described as a most important feature and development—an original contribution to laboratory construction.

Standing at the point where the "T" of the laboratories structure is crossed, on each of the three floors one looks to the right and left down the 244-foot corridors or wings. The total length of a corridor from end to end is 488 feet. That is the span across the top of the "T." The doors on both sides of these spacious hallways on all three decks open to the many laboratory bays, and to nine administrative research offices and workshops. On the main floor, the general office section is near the entrance. Executive offices are in a section on the third floor.

Entering one of the laboratory bays, visitors are impressed with the spaciousness and broad daylight exposure, supplemented by modern indirect lighting, which casts no shadows. The work-benches are so designed and arranged as to be a joy to any worker. A wiring trough extends along the top of each bench, and the markings on the panel outlets indicate that almost any phase of electric current—AC or DC, and at various voltages, is at the finger-tips of the experimenter. In addition, there are taps on the bench for air, gas and water, as well as hydrogen and oxygen in the bays where they are used. And, of course, there are convenient electric plugs for soldering irons and other electrically operated tools. Flexibility in construction is the keynote.

The many laboratory bays indicate a great variety of activity within the laboratories. The Television Laboratory is described as "the last word in facilities for television research." Other laboratory bays are devoted to research in chemistry, especially fluorescent materials; acoustics, radio facsimile, centimeter-wave transmission and reception, receiving tubes, cathode ray tubes, transmitter tubes, under-water sound and various activities associated with the future of radio and electronics.

The model shop is considered to be the most modern of its kind and the best equipped in the world. For example, the meter room has complete calibrating equipment and 3,000 different meters available for covering voltage, current, temperature and speed. The Technical Library of the laboratories is catalogued as "complete in the communication field." There is an ultra-modern kitchen which adjoins a cafeteria with a capacity to serve from 180 to 200 persons at a time.

SCIENTIFIC RESEARCH IN WAR AND PEACE

THANK you, General Harbord and Mr. Schairer, for inviting me to attend the dedication of the RCA Laboratories. It's comforting to know that one is not forgotten by his own family, even when he is as far away from home as Washington. It is a real privilege to be here to-day and see in being the dreams of years.

When the cornerstone of this building was laid in November of last year, I attended the ceremonies by radio on board a ship on the Pacific Ocean somewhere between Honolulu and San Francisco. At that time we were blissfully unaware of what was immediately ahead of us. At the very hour the cornerstone was put in place, the plans of the Japanese war staff to attack Pearl Harbor must have been completed. The enemy ships and planes, which three weeks later were to plunge this nation into war, were in readiness to set forth on their treacherous mission. Our days of peace were numbered, and their number was very few.

It is significant that the foundations of this building were laid in time of peace, and its superstructure has been raised in time of war. Similarly, the modern sciences of radio and electronics have their roots in peaceful soil—in the search by men of good will for ways and means to make the world a better place to live in. Yet these sciences, and all science, are now enlisted in total war.

Total war as it is fought to-day is more than a war of populations or mere quantity of weapons or alone the human qualities of courage and endurance. More than ever before in history, this war is a contest between the brains and imagination and teamwork of the scientists, engineers and production workers of one group of nations, pitted against those of another group. While it is true that the decision ultimately will be made on the battlefield, the high seas and in the air, the fighting men who have the greatest resources of science, engineering and production back of them will be the victors.

Most people are aware that science is making a tremendous contribution to modern war in terms of guns, high explosives, airplanes, radio and synthetic rubber. By developing and improving these vitally important

products, a comparatively small number of scientists may be a far more powerful fighting force than an enemy army of millions of men.

But scarcely less important are scientific developments in many fields of chemistry, medicine and agriculture. Plastics, synthetic textiles, dehydrated foods, high-octane gasoline, aluminum, magnesium and scores of other materials and products important to the war effort are being produced on a vast scale, thanks in large measure to American industrial research.

Developments like these are the result of organized scientific effort, in laboratories such as the one you dedicate here to-day. But organized research is a peace-time product, the result of the slow and careful assemblage of men and facilities long before the urgency of war makes its call for the utmost efforts of a nation.

The United States has been fortunate in the vision of its private enterprises and universities which, long prior to the war, assembled such staffs and built such facilities. True, they did not build them to serve as adjuncts to military forces, as did our enemies. America's purpose was not the conquest of other nations, but conquests over the forces of nature, over ignorance, over poverty, over disease.

Our country is fortunate too that the officers and men in its military and naval establishments, on land, at sea and in the air, have a progressive attitude towards scientific research. They realize its possibilities, not only as a factor in war, but also in peace.

Indeed, the scientists in the laboratories of the Army and Navy and other government departments themselves have made scientific contributions from which our country has benefited in the past and will continue to benefit in the future.

And now, these fine minds and these superb facilities developed to serve peaceful ends are being brought to bear upon the gravest problem which they have ever faced—the problem of survival against ruthless aggression backed by prolonged military preparation.

Only a portion of America's scientific manpower has been fully used thus far in the war effort. The results, however, are already apparent, both in new and improved equipment of our fighting forces, and in the ingenuity displayed by industrial laboratories in developing ways of overcoming problems such as the shortages of critical materials. I have no doubt as to the ultimate result when all our available forces of science are organized and applied to the single purpose of achieving victory.

Of all the fertile fields which American men of science have cultivated for peace and now harvest for war, radio is in the first rank of importance. Speed of communication—on land, at sea and in the air—is the essence of modern warfare.

Aviation, which has so radically revolutionized military and naval strategy, is particularly dependent upon the countless services of radio. We could not have efficient aviation without radio any more than we could have city skyscrapers without elevators.

Admiral Dewey, hero of Manila Bay, would not recognize the radio control room of a modern battleship, where dozens of transmitters and receivers maintain constant communication with other ships, with stations on shore and with planes overhead.

And on land, tanks, armored cars and infantry units carry specially designed radio equipment which enables them to move and to strike with maximum power and precision.

It is particularly fortunate that during the period prior to America's entry into the war the Radio Corporation of America built up its research organization, and that RCA scientists and engineers gained experience along lines that are now of vital military importance.

In the last analysis, a research laboratory consists not so much of buildings and facilities as it does of research men and research leadership. The staff of these laboratories is as fine a group of radio scientists as exists anywhere in the world. They have produced outstanding developments in new electronic devices, in television, in ultra-short waves, in acoustics and in many other branches of radio research. The skills which they developed before the war are now finding direct use in important military applications.

The Spanish writer, Madariaga, once remarked that statesmen were of two kinds—paper men and gold men. The paper men, he said, had value only in a certain place at a certain time. The gold men were good anywhere, anytime.

There are paper men and gold men in every walk of life, but if we were asked among what group we had met the highest percentage of gold men, I think many of us would say it was among the men of science. The explanation may be that they dedicate their lives to an endless search for the pure gold of scientific truth, and are never satisfied with any baser metal.

Consequently, our admiration for these laboratories is based upon more than their obviously fine qualities of architecture and construction. We are moved by the deep respect in which we hold the virtues of scientific accuracy and intellectual integrity. These are virtues possessed to a high degree by the type of men who will work within these walls. These are the qualities which are helping to preserve our civilization, and which in turn make our civilization worth fighting for.

We congratulate you, Mr. Schairer, and your associates upon the completion of this home of RCA Laboratories. You are dedicating it to-day to the cause of victory for the United Nations. Until that victory is achieved, this building and the men who

work here can aim toward no higher goal, can accomplish no greater good, than to serve that cause, heart and soul.

The day of victory will surely come, and the words "Peace on earth, goodwill to men" will again ride the radio beams of all the world. Then America's men of science will draw upon their wartime research to develop finer and more useful products and services for peace-time purposes. Out of the ashes of war, they will bring forth implements for a new and better civilization.

DAVID SARNOFF

THE ROLE OF RESEARCH IN MODERN INDUSTRY

ON behalf of the staff of RCA Laboratories I extend to you a cordial welcome to our new home.

We are happy and proud to show you to-day the initial group of buildings which have been planned for erection here. They are the beginnings of a development which will make this place the center for the creative and forward-looking activities of the RCA family.

By accessibility of location, spaciousness of setting, utility but dignity of architecture and efficiency of equipment, we have endeavored to provide facilities and an atmosphere here that will be especially conducive to effective original work. We intend to make this place increasingly attractive in order to induce you and others to come here frequently for research services and for contemplation of the problems and the future of the radio and electronic art and industry.

These new laboratories are a monument to past research—to achievements which have brought into instantaneous communication with each other the most remote points on land and sea and in the air. By signals, by voice and by pictures, the miracle of radio has disseminated information, education, entertainment and culture to all the peoples of the world. Such contributions have made possible the laboratories we are dedicating to-day.

But these laboratories are more than a memorial to past triumphs. They are concrete recognition that research plays an essential role in modern industry; that it is a vital force for promoting the progress of science and the useful arts. They are intended to be a further contribution to industrial advancement and to social betterment by an organization whose services to the public and whose origin and progress have been based upon scientific research and original development.

Scientific research is diligent quest into the great unknown. It is the key that unlocks the doors of nature and reveals its mysteries and secrets. It frees mankind from fetters and limitations seemingly imposed by natural forces and by environment. It extends the boundaries and horizons of human knowledge and experience.

Research is a modern equivalent of geographical exploration whereby in former times new lands and additional natural resources were discovered and made available. But to-day, when there are no more continents for geographers to discover, the research explorer is faced with no such predicament. He never exhausts his field. Each new discovery seems to make research only more endless. Vast new areas are continuously being opened for development and practical use, and there is no apparent limit to the potential resources yet to be uncovered by science.

In radio and electronics we know this. There research has progressively extended the useful portions of the radio spectrum, until its availability for future communication and other services now appears to be almost limitless. Television is only one of the many new wonders for which a place has been made by such extensions. Great new regions never before seen by man have also been made visible by the electron microscope, which is profoundly influencing further developments in many branches of science and industry. Countless other new things previously undreamed of are being made realities by radio and electronic research.

In other fields science has created new materials, such as plastics; new synthetics, such as rubber and silk; new medicines, such as the sulfanilamides; new textiles; new colors, new metals and alloys; and it has produced new achievements in aviation, in transportation and housing.

Scientific research is a great provider and producer of employment for all classes of people. It affords an outlet for exercise of the imagination and genius of scientists and inventors. Through it their special talents give their best and most useful expressions. And the industries brought into being and vitalized by it employ myriads of other workers and vast amounts of capital.

It is distinctively constructive and beneficial. It does not invade the fields or destroy the rights of others. Its conquests are won only in the realm of the previously unknown and non-existent. Truly it is an instrument of the first order of social and economic importance.

With prophetic vision and wisdom our forefathers framed measures for the encouragement of scientific research—patent laws for protecting the inventions which are its logical results. No more effective or economical method of promoting the progress of science and the useful arts has ever been devised. It has been the bulwark of our industrial and social progress. It has stimulated the translation of scien-

tific discoveries into industrial achievements. It has accelerated the movement of inventions into the humblest homes.

Without our patent system, research would languish, the streams of invention would become mere trickles, our industrial supremacy would be lost, employment would be reduced, and improvements in our standards of living would be retarded.

Let us, therefore, preserve this wholesome system unimpaired in order that we may continue to enjoy the maximum benefits of research and invention. Let us be careful in attempting to effect desirable improvements in this system and to prevent its misuse, we do not weaken or destroy it. And let us also, by every means at our command, promote and expedite the distribution of its benefits to all the people.

These laboratories are not intended to pre-empt the field of radio and electronic research. In science, as in everything else, competition is the greatest spur to healthful activity. The scientists who will man the work benches in these laboratories have been in keen but friendly competition with other scientists throughout the years. The sum of the effects of all of them has greatly accelerated scientific progress.

In the alliance of science with modern industry we need both individual inventors and organized research groups. Each has its field. The flame of some men's genius burns brightest alone. Many of our greatest inventions have been made by individual scientists, with primitive equipment and with little or no help, save the inspiration of their own unquenchable spirits.

But there are many inventions that could never be made and developed in that way. They call for systematic research and for organizations of men, of materials, of equipment, of resources. The workers in these modern and efficient laboratories will have at their command all these essential factors. They will also have a valuable association with the communications, broadcasting and manufacturing services of the Radio Corporation of America. These services will be sources of ideas for development as well as of problems for solution. They will also be proving grounds for testing inventions and new devices in actual service and production. And the inventions that crystalize here will also be available under licenses to the whole radio and electronic industry.

I want to pay respectful tribute to the directors of the Radio Corporation of America for their vision, courage and broadmindedness in authorizing the building of this institution as a means of broadening and strengthening the foundations of the Corporation and of the radio and electronic industry.

Earnestly and constantly the workers in these laboratories will endeavor to render services and to produce results which will justify the confidence in them, and in the efficacy of scientific research, which is demonstrated by this wise investment for the future.

To-day, RCA Laboratories and its magnificent enrolment of men, buildings and equipment stands enlisted in the cause of war. When we leave here today, the gates will be closed to others than war workers. These structures will then be as much a part of the nation's armament as are its arsenals and forts. The men who work here will be as much members of its armed forces as if they were in the trenches on the battlefields. The work they will do will be military secrets carefully guarded against leakage or intrusion.

But I can give you this prophecy: the scientific progress made here will play a most important part on all the battlefields—on land and sea, under the sea and in the skies. When the war ends, and the ban of secrecy is lifted, the recital of accomplishments will thrill all of us and fill us with justifiable pride.

But when the war ends—when the victory is won—these men and these laboratories will stand dedicated in advance to serve the cause of a victorious peace. For therein lies the distinctive characteristic of our scientific endeavor. Its destructive power is one of the greatest weapons of war, and its constructive power is one of the greatest assets of peace. The same radio and electronic discoveries which these laboratories will have forged into weapons to tear down the ramparts of our enemies will also serve to rebuild the structures of our peace.

Because men work to-day in laboratories like these, new cities will rise from the ruins of the silent battlefields, richer crops will be harvested from the black stubble of scorched earth, and finer homes—richer at least in material things—will replace the homes that have been devastated by war.

The triumphs of science warrant our saying—amid all the horrors of war—there is still hope for civilization.

To help make that hope come true is the purpose to which these new laboratories are dedicated.

Otto S. Schairer

OBITUARY

FERNAND HOLWECK

1889–1941

The news comes from unoccupied France that Dr. Fernand Holweck, director of research of the "Centre National de la Recherche Scientifique" and associate professor of physics at the Institute of Radium of the Sorbonne (Laboratorie Curie), was murdered by the Gestapo on December 14th, 1941, in a Paris prison. Further details are missing.

Dr. Holweck, born in 1889, graduated in physics

from the "Ecole de Chemie et Physique" of Paris, the school made illustrious by some of the greatest French physicists, among them Pierre Curie and Paul Langevin. In 1912 he became assistant to Madame Curie, and since that time all his activity was connected with the Curie Laboratory, which he helped to organize.

Holweck's thesis for the degree of science doctor was the well-known study on soft x-rays, which bridged the gap in our knowledge between the far ultraviolet region and x-rays. This study is a classic which still supplies most of the available information on the x-ray spectra of the elements of low atomic number. In the course of this research, Holweck's interest had been directed to the problem of high vacuum production: the result was the design of the Holweck molecular pump, the most powerful vacuum-producing device prior to the invention of the vapor diffusion pumps. Other of his important achievements in the field of applied physics are: the Holweck gravimetric pendulum, a tool that proved of the utmost utility in the oil survey technique; a high power radio tube which could be disassembled, and the first x-ray tube with successive stages of acceleration. Moreover, during research on television, he was among the first to develop the use of the focusing of electrons and to pioneer the developments of electron optics.

Through his lifelong friendship with Dr. A. Lacassagne, now head of the Pasteur Laboratory of the Institute of Radium, Holweck became interested in radiobiology. In 1929 he rediscovered, independently of previous work by Crowther, the quantic interpretation of the biological action of radiation on micro-organisms. In the following years he made fundamental contributions in this field with studies on bacteria, fungi and viruses.

During the first World War, Dr. Holweck had substantially contributed to the application of science to defense, by studying with Langevin and Chilowsky the detection of submarines by means of ultrasonic waves. From the onset of the second World War until the defeat of France, he was actively engaged in defense work, and obtained some of the finest results achieved by French scientists in this field.

Less known than his personal achievements are Holweck's contributions to most of the research that was performed in the Curie Laboratory since its foundation. His tremendous skill as an experimenter (he was a man for whom technical difficulties just "did not exist") and his sympathetic disposition made him the willing adviser of all the scientific workers in his entourage. Many an important research was made possible by his uncanny ability to discover the way out of some technical bottleneck. Moreover, it is not an exaggeration to state that he contributed more than anybody else to the systematization of the radioactive technique, which was created in the Curie Laboratory and spread thence throughout the world.

With the exception of painting, for which he had a particular gift, Holweck's hobbies were mainly scientific. An amateur astronomer, he had built in his Paris home a complete observatory equipped with a 10-inch telescope, a source of admiration and envy of many professional astronomers. He was about to publish a study on certain peculiarities of Jupiter's satellites.

The privilege of collaborating with Holweck enabled the writers to appreciate not only his inspiring personality and deep humanity, but also the inflexible independence of his character. This independence was perhaps responsible for the fact that his ability was not always duly recognized. It is easy to imagine that such a man would refuse not only collaboration, but even obedience to the iniquitous Nazi rule in France. He has paid with his life for his love for freedom and for his country. His example will inspire all scientists of the world in their fight for the cause of liberty and democracy.

S. ROSENBLUM
S. E. LURIA

RECENT DEATHS

DR. ROSS A. GORTNER, chief of the division of biochemistry of the University of Minnesota, died on September 30. He was fifty-seven years old.

DR. WILLIAM COLEMAN STURGIS, from 1905 to 1914 dean of the School of Forestry of Colorado College, previously, from 1891 to 1901, connected with the Connecticut Agricultural Station, and for ten years educational secretary of the Board of Missions of the Episcopal Church of New York, died on September 29 in his eightieth year.

SCIENTIFIC EVENTS

EMERGENCY BASE HOSPITALS

SELECTED hospitals and medical schools in the coastal states have been invited by the Surgeon General of the U. S. Public Health Service to organize affiliated staff units which will be ready to serve when needed to supplement the medical staffs of Emergency Base Hospitals, now being designated by the Medical Division of the Office of Civilian Defense. These units resemble the affiliated hospital units of the Army except that they are smaller in size. They are being organ-

ized in order to assure suitable status and remuneration for physicians who may be called upon in the event of an enemy attack in their locality to care for casualties and other patients who have been evacuated to the interior of their region.

The designation of Emergency Base Hospitals and the formation of affiliated units are part of a joint hospital program of the Medical Division of the Office of Civilian Defense and the U. S. Public Health Service. The program is authorized under an agreement concluded on March 2, 1942, between the Federal Security Administrator and the director of the Office of Civilian Defense.

Physicians in the affiliated units will be commissioned in the inactive Reserve Corps of the Public Health Service. Unless an urgent need for their services should arise, they will remain on an inactive status for the duration of the war. They will be called to active service only if hospitals in their regions must be evacuated and the civilian populations must be moved because of military necessity. Activation of the units will take place by order of the Surgeon General at the request of the Chief Medical Officer of the Office of Civilian Defense on advice of the Regional Medical Officer and the State Chief of Emergency Medical Service in charge of the affected areas.

The commissions will be in grades ranging from Passed Assistant Surgeon to Senior Surgeon, and when units are activated, these officers will have the rank, pay and allowances equivalent to those of officers in the armed forces.

Institutions invited to form units are asked to nominate an outstanding physician or surgeon as Unit Director, who, if he meets the physical and other requirements, will be commissioned Senior Surgeon in the Public Health Service Reserve. The Unit Director will then nominate the remainder of the staff and appointments will be made after clearance through the State Chief of Emergency Medical Service. Nominations are to be limited to male physicians over 45 years of age, to those under that age who have physical disabilities which disqualify them for military service but which do not interfere with their professional activities, and to women physicians.

In order to avoid serious depletion of the professional staffs in the medical schools and hospitals of the target areas, the Surgeon General has recommended that medical schools draw their affiliated units in part from associated hospitals and that non-teaching hospitals invite physicians from other qualified hospital staffs to collaborate.

THE NATIONAL REGISTRY OF RARE CHEMICALS

The National Registry of Rare Chemicals, Armour Research Foundation, Thirty-third, Federal and Dearborn Streets, Chicago, receives requests for sources of certain chemicals at a rate of approximately two hundred and fifty per month.

Dr. Martin H. Heeren, director of the registry, sends a list of chemicals for which no source is known to the registry. If any reader has one or more in his laboratory, he is urged to communicate with the registry. Even small amounts are important, inasmuch as all requested chemicals are to be used for experimental purposes only.

1. Diamino acetone
2. Myosin
3. Dysprosium
4. Luetecium
5. Terbium
6. Divinyl Benzene
7. Mercuric Fluoride
8. 3-Pyridine Acetic Acid
9. Glucose-1-Phosphate
10. Hexose-6-Phosphate
11. Acetyl Phosphate
12. Phosphoglyceraldehyde
13. Blood Charcoal
14. Alpha-Phosphoglycerol
15. d-3-Phosphoglyceraldehyde
16. d-3-Phosphoglyceric Acid
17. Alpha-Ketoglutaric Acid
18. Quinone Dioxime Dimethyl Ether
19. Diquinoyl Dioxime
20. Diquinoyl Tetroxime

THE OFFICE OF TECHNICAL DEVELOPMENT

A committee of engineers and scientific men has been appointed by Chairman Donald M. Nelson to determine the manner in which the projected Office of Technical Development should be set up within the War Production Board, and to define the scope, functions and method of operations which the office should have.

Decision to establish such an office was made earlier, following a report by a previous committee recommending that the War Production Board set up a strong scientific and technical organization to make sure that the nation's technical ability and resources were utilized to the full in the war production program.

The chairman of the new committee is Webster N. Jones, director of the College of Engineering of the Carnegie Institute of Technology at Pittsburgh. Other members are:

Dr. Lawrence W. Bass, director of research, New England Industrial Research Foundation, Boston.

Dr. Oliver E. Buckley, president, Bell Telephone Laboratories, New York.

Colonel Clarence E. Davies, Ordnance Department, U. S. Army, Washington.

Dr. Ray P. Dinsmore, manager, Development Department, The Goodyear Tire and Rubber Company, Akron, Ohio.

Admiral J. A. Furer, U. S. Navy, Washington.

Dr. Jerome C. Hunsaker, head of the departments of mechanical and aeronautical engineering, Massachusetts Institute of Technology.

H. W. Graham, director of metallurgy and research, Jones and Laughlin Steel Corporation, Pittsburgh.

S. D. Kirkpatrick, editor of *Chemical and Metallurgical Engineering*, New York.

LEAVES OF ABSENCE FOR WAR SERVICE AT THE UNIVERSITY OF MICHIGAN

DR. UDO J. WILE, professor of dermatology and syphilology and chairman of the department at the University of Michigan, has been given a year's leave of absence to enable him to accept a commission as colonel in the Army. He will serve as medical director in charge of venereal disease control in the U. S. Public Health Service.

Dr. Henry M. Kendall, assistant professor of geography, has leave for the first semester of the academic year to accept an appointment to work with the Geographic Section of the Army Intelligence.

Dr. Malcolm H. Soule, professor of bacteriology and chairman of the Hygienic Laboratory, has been on leave of absence since September. He was consultant to the director of the Division of Health and Sanitation, coordinator of Inter-American Affairs at the Pan-American Sanitary Conference in Rio de Janeiro, September 7 to 17. He will remain in South America until the end of November investigating the activities of the division in that continent.

Dr. Lowell T. Coggeshall, professor of epidemiology, has leave of absence for the months of September and October. He is in Washington organizing medical facilities for the prevention of tropical diseases.

THE DEPARTMENT OF ZOOLOGY OF COLUMBIA UNIVERSITY

CHANGES in the staff of the department of zoology of Columbia University and the appointment of an advisory committee composed of zoologists in other institutions are announced by President Nicholas Murray Butler.

Professor James H. McGregor, who has been a member of the department since 1897, becomes professor emeritus of zoology. He will continue to give his course on "The Evolution of Man" in the Department of University Extension during the winter session.

Professor H. Burr Steinbach, assistant professor of zoology since 1938, has resigned to become associate professor in the department of zoology at Washington University. Professor Arthur W. Pollister, assistant professor of zoology since 1935, has been promoted to be associate professor.

Dr. Robert Ballentine, National Research Council fellow at the Rockefeller Institute for Medical Research, has joined the department as lecturer in zoology. He will be associated with Professor Franz Schrader in instruction in elementary zoology and with Professor Pollister in the zoological part of the general science course in Columbia College.

Dr. Francis J. Ryan, National Research Council fellow at Stanford University, returns to Columbia as instructor in zoology. He will give the course in vertebrate zoology for students at Columbia College and will offer a course in invertebrate zoology for graduates and undergraduates. Mordecai Gabriel, lecturer in zoology, has been appointed university fellow.

Dr. Hans Ris, lecturer in zoology, has been appointed Seessel fellow in Yale University. Vernon Bryson has completed his work for the doctorate, and has been appointed to the research staff of the department of genetics of the Carnegie Institution of Washington, Cold Spring Harbor, L. I., N. Y. Dr. Daniel C. Pease, lecturer in zoology, has joined a war research project in the department of biology of Princeton University.

Members of the new Advisory Committee on Zoology, each of whom will serve for three years, are Professor H. B. Goodrich, Wesleyan University; Professor E. N. Harvey, Princeton University; Professor D. E. Lancefield, Queens College; Professor C. W. Metz, University of Pennsylvania; Professor H. J. Muller, Amherst College; Dr. W. Procter, Academy of Natural Sciences, Philadelphia; Professor A. S. Romer, Harvard University, and Professor L. L. Woodruff, Yale University.

The committee, it is planned, will hold annual meetings at Columbia to give the members of the Columbia department staff the benefit of their criticism and advice and to serve as a liaison between the department and the zoologists in other universities.

NATIONAL LECTURERS OF THE SOCIETY OF THE SIGMA XI

DR. GEORGE A. BAITSELL, secretary of the Society of the Sigma Xi, the national honor society for the promotion of scientific research, announces that five leading American scientific men have been named Sigma Xi national lecturers for 1943.

Chosen to address special meetings at universities and colleges throughout the nation, they will deliver their lectures during January, February, March and April of next year, and will discuss scientific subjects upon which they are authorities.

Each of the lecturers will speak in a series of insti-

tutions at dates and places to be announced later. The Sigma Xi lectures are annual events in the dissemination of the newest, important advances in the selected fields of science. The lecturers are:

Dr. G. D. Birkhoff, Perkins professor of mathematics at Harvard University, who will lecture on the "Mathematical Nature of Modern Physical Theories." He will endeavor to establish, in elementary terms, the fact that, since 1900, mathematical ideas have been responsible for theoretical advances of modern physical theories.

Dr. D. W. Bronk, professor of neurology at the University of Pennsylvania, will speak on the "Physical Structure and Biological Action of Nerve Cells." He will discuss this subject not only from the standpoint of research now in progress, but also with attention to the biological consequences of the demands of modern warfare and aviation.

Dr. Peter Debye, professor of chemistry at Cornell University, whose topic is "The Magnetic Approach to Absolute Zero," will tell what prevents science from reaching the absolute zero, and discuss whether magnetic cooling can be applied to the nucleus of the atom.

Dr. C. A. Elvehjem, professor of agricultural chemistry at the University of Wisconsin, will discuss "The Present Status of the Vitamin B Complex." He will explain that the vitamin B complex consists of at least a dozen separate factors, each of which can be obtained in pure form. He will report recent work on the use of sulfaguanidine and the evidence for the synthesis of several B vitamins in the intestinal tract.

Dr. H. Mark, professor of chemistry at the Brooklyn Polytechnic Institute. The title of his lecture is "Fundamental Aspects of the Elasticity of High Polymers." He will explain that the high polymers are chemical compounds that provide us with rubber, plastics and fibers. Dr. Mark will discuss the structure of these complex chemicals which mean so much to our war effort.

SCIENTIFIC NOTES AND NEWS

JOSIAH K. LILLY, since 1882 chairman of Eli Lilly and Company, has been awarded the twenty-first Remington Medal by the Philadelphia College of Pharmacy in recognition of his distinguished services to pharmacy. The committee of selection was composed of past presidents of the American Pharmaceutical Association. The presentation of the medal is expected to be made in the autumn at a meeting of the New York branch of the association.

MAJOR GENERAL ROBERT U. PATTERSON, U. S. Army, retired, dean of the Medical School of the University of Oklahoma at Oklahoma City, having reached the retirement age of sixty-five years, has submitted his resignation.

DR. HARRY NOBLE WRIGHT, formerly professor of mathematics at the College of the City of New York, who has for eight months served as acting president, was installed as sixth president of the college on September 30. The principal address was made by Dr. Felix Frankfurter, justice of the Supreme Court. Among other speakers were Mayor LaGuardia and Dr. Nelson P. Mead, chairman of the department of history and for three years acting president of the college.

THE Michigan College of Mining and Technology has made the following appointments to replace men who have leave of absence in order to serve with the armed forces: Professor O. Gaylord Marsh, a former consul general of the United States with service in Canada, Europe, Latin America and Korea, special lecturer in world affairs and a member of the Spanish division of the languages department; Drs. George Machwart, A. R. Kendall and Ernest Epperson, department of chemical engineering; and Jesse C. Butler, Earl Roberts and Thomas R. Richards, instructors in mathematics. Dr. Machwart has the rank of associate professor and Dr. Kendall that of assistant professor.

APPOINTMENTS of those who received in August doctorates of philosophy in agricultural and biological chemistry at the Pennsylvania State College are: James Russell Oyler, Nutrition Foundation research fellow at Columbia University; Isadore Zipkin, First Lieutenant, Sanitary Corps, U. S. Army; Laurence L. Layton, research department, Distillation Products, Inc., Rochester, N. Y.; Gertrude H. Spremulli, Ranger Aircraft Engines, Farmingdale, L. I.; Seymour S. Block, Seagram's, Lawrenceburg, Ind.

DR. I. FANKUCHEN, formerly of the University of Cambridge, England, has joined the staff of the department of chemistry of the Polytechnic Institute of Brooklyn for the coming academic year. Dr. Fankuchen, a former associate of Dr. W. L. Bragg, is known for his investigations in the field of x-ray and electron diffraction. The laboratory will be under the supervision of A. L. Davis, of the Polytechnic staff. Both the lecture and laboratory sessions will be held on Saturdays from 9 A.M. to 1 P.M., beginning on October 10.

AT Hofstra College, Dr. J. George Lutz has been made associate professor of chemistry and acting chairman of the department; Dr. E. Russell Stabler has been appointed assistant professor of mathematics, Dr. Leonard B. Brabec, assistant professor of chemistry, and H. Hunter Smith, assistant professor of physics.

SIR JOHN ORR, director of the Rowett Research

Institute, Aberdeen, has been appointed professor of agriculture in the University of Aberdeen. He will retain the directorship of the institute.

THE John and Mary R. Markle Foundation has authorized a grant-in-aid of $7,000 over a two-year period for the support of the research in experimental renal hypertension in progress at the College of Medicine of the University of Illinois. The work is under the direction of Dr. George E. Wakerlin, professor and head of the department of physiology. Dr. C. A. Johnson, assistant professor of physiological chemistry; Dr. E. L. Smith, instructor in physiology, and others are associated in the investigation.

THE following grants have been made by the Committee on Scientific Research of the American Medical Association: Frederick M. Allen, New York Medical College, Local Refrigeration in Surgery; Walter Schiller, Cook County Hospital, Chicago, Ovarian Tumors; Meyer M. Harris, Psychiatric Institute, New York, Further Research on Muscular Disease; Arthur H. Smith, Wayne University College of Medicine, Metabolism of Citric Acid; Tuberculosis Committee, Minnesota State Medical Association, J. A. Myers, *chairman*, Tuberculosis Survey of Meeker County, Minnesota.

JOHN TEE-VAN, executive secretary of the general staff of the New York Zoological Society and an associate in the department of tropical research, has been appointed acting curator of reptiles, to succeed Raymond L. Ditmars, who died on May 12. Mr. Tee-Van became associated with the society in 1911, when he was appointed assistant keeper in the department of birds.

G. DALLAS HANNA, curator of the department of paleontology of the California Academy of Sciences, San Francisco, has been appointed in addition administrative assistant to the director.

DR. STANLEY J. SEEGER, Texarkana, Texas, chairman of the Council on Industrial Health of the American Medical Association, according to the *Journal* of the association, has been named consultant to the Division of Industrial Hygiene of the National Institute of Health.

DR. FERDINAND W. HAASIS, senior clerk, U. S. Army Quartermaster Corps, Camp Roberts, Calif., has been appointed to senior scientific aide in the Special Guayule Research Project of the U. S. Bureau of Plant Industry, Salinas, Calif.

CAPTAIN CHARLES W. O. BUNKER, commander of the Naval Medical School, Bethesda, Md., has been assigned to command the Naval Medical Center at Bethesda and has been nominated for promotion to rear admiral. He succeeds Rear Admiral Charles M. Oman, who will become commanding officer of the Naval Convalescent Hospital, Harriman, N. Y. Captain Paul W. Wilson has been named to succeed Captain Bunker as head of the School of Medicine.

DR. FRANKLIN G. EBAUGH, professor of psychiatry of the School of Medicine of the University of Colorado and medical director of the Psychopathic Hospital, has leave of absence for the duration of the war. With the rank of lieutenant colonel he will serve as chief psychiatric consultant with the Eighth Service Command. His headquarters are at Fort Sam Houston, San Antonio.

CHARLES F. BONILLA, of the department of chemical engineering of the Johns Hopkins University, who has been appointed a member of the Board of Economic Warfare, has left for an eight weeks' trip to Brazil.

DR. MAYNARD A. JOSLYN, assistant professor of fruit technology at the University of California, who has been commissioned a captain in the U. S. Army, has been selected to aid in the development of a food dehydration industry overseas. He is one of two men who will be placed in charge of the development of the industry. The other, who will be a Canadian, has not yet been selected.

W. G. HOWARD, of the Department of Forests, Albany, has been appointed state area coordinator for New York State for the new Forest Fire Fighters Service of the Office of Civilian Defense.

DR. GEORGE BAEHR, chief medical officer of the Office of Civilian Defense, has gone to England to study Britain's Emergency Medical Service and to confer with medical leaders. Dr. Baehr will remain abroad for several weeks.

DR. E. C. STAKMAN, chief of the division of plant pathology and botany of the University of Minnesota and agent for the U. S. Department of Agriculture, will deliver an illustrated lecture on "Genetic Variation in Plant Pathogens and Its Practical Importance" on Friday evening, October 23, at a joint meeting at the Palmer House of the Institute of Medicine of Chicago and the Chicago Society of Internal Medicine.

THE program of Laity Lectures for the coming session at the New York Academy of Medicine is as follows: November 12, "Food and Civilization," Dr. R. R. Williams; December 10, "War and Medicine," Colonel Edgar Erskine Hume; January 28, open; February 25, "Aggressiveness—Individual and Collective," Dr. Franz Alexander; March 25, "Growing up Normally," Dr. Myrtle McGraw; April 22, "Crime and Punishment," Dr. Bernard Glueck.

THE Association of American Geographers will

hold its 1942 annual meeting at Columbus, Ohio, on December 28, 29 and 30, with sessions conducted at the Ohio State University. The program will be devoted primarily to facts and problems related to the war and to the post-war period of reconstruction. A joint session with Section E of the American Association for the Advancement of Science in New York has also been planned. The geographical contributions to this joint session will present a series of papers dealing with Latin America.

The fifty-sixth annual meeting of the Association of Land-Grant Colleges and Universities will be held in Chicago at the Drake Hotel on October 28, 29 and 30. Preliminary meetings will be held as required during the period from October 24 to 27. The meeting this year is encouraged and its importance emphasized by the recent statement of the Science Committee "that the present emergency calls for the greatest mobilization of scientists, scholars and educators in the history of the United States, and it is clear that the societies and associations into which they are organized have an important part in the war effort. This part includes not only direct participation by scientists, technologists, scholars and others in war activities, but also the discussion of present and future problems and the maintenance of a vigorous intellectual life."

The annual meeting of the American Science Teachers Association will be held at the Hotel Pennsylvania, New York City, on Tuesday and Wednesday, December 29 and 30.

Dr. A. V. Kidder, president of the American Anthropological Society, has made the following announcement: "In view of the fact that scientific organizations whose activities are not directly concerned with the war effort have been requested by the coordinator of transportation not to hold meetings, the executive committee of the American Anthropological Association has voted to postpone until after the war the scheduled annual meeting in Toronto. As, however, the constitution of the association requires that a meeting be held annually for the presentation of reports, the election of officers and the passage of the budget, it has been decided to hold a meeting for business purposes only at the Cosmos Club in Washington at 8:30 on the evening of December 29. Washington has been selected for this purpose because the necessary quorum of twenty members can be obtained with a minimum of travel."

The new Mineral Industries Building of West Virginia University at Morgantown will be dedicated on October 16.

The American Gastroenterological Association on January 1, 1943, will publish the first issue of a new journal to be called *Gastroenterology*. It will be owned by the association and will be its official publication. It will appear monthly and will be published by the Williams and Wilkins Company. Dr. W. C. Alvarez has been made editor (after June, 1943) and Dr. A. C. Ivy, assistant editor, with the following editorial board: Drs. A. H. Aaron, Buffalo; J. A. Bargen, Rochester; H. L. Bockus, Philadelphia; W. C. Boeck, Los Angeles; B. B. Crohn, New York; R. Elman, St. Louis; F. Hollander, New York; Sara Jordan, Boston; J. L. Kantor, New York; B. R. Kirklin, Rochester; P. Klemperer, New York; F. H. Lahey, Boston; F. C. Mann, Rochester; H. J. Moersch, Rochester; V. C. Myers, Cleveland; W. L. Palmer, Chicago; J. M. Ruffin, Durham; R. Schindler, Chicago; and D. L. Wilbur, San Francisco. The journal will print clinical and investigative contributions which are of interest to the general practitioner as well as to the specialist dealing with the diseases of digestion and nutrition, including their physiological, biochemical, pathological, parasitological, radiological and surgical aspects. Manuscripts should be sent to Dr. A. C. Ivy, *Gastroenterology*, 303 East Chicago Avenue, Chicago.

The fourth ten-year Index of the Electrochemical Society, covering the years 1932 to 1941, inclusive, is now in press. Every subject discussed in the transactions of the society during the past ten years has been indexed and cross-indexed. This book of two hundred pages is a convenient source of accurate and up-to-date information covering every topic of interest in electrothermics, electrodeposition, electronics, theoretical electrochemistry and allied fields.

An electron microscope has recently been purchased by the University of Missouri from the RCA Manufacturing Company and is now being installed in a centrally located laboratory where it may be used by all investigators who have use for such an instrument, as those in the departments of soils, zoology, botany, chemistry, physics and geology.

According to the *Times*, London, the University of Durham has received an offer from the Nuffield Provincial Hospitals Trust to provide a grant of £15,000 towards the cost of establishing a chair of child health at King's College, Newcastle-on-Tyne. The senate and court of the university have accepted the proposal. They have appointed Dr. J. C. Spence as professor, and the council of King's College has expressed its intention to provide him with the assistance necessary for creating a full teaching and research department. The Royal Victoria Infirmary and the Babies' Hospital, Newcastle, will cooperate with King's College by providing all possible facilities for the new department, which will be concerned with the preservation and restoration of the health of children. The department will provide undergraduate

and post-graduate teaching in child health and the diseases of childhood, will be a center of research and will be at the disposal of local public health and education authorities of the region for advice and consultation in the conduct of their child welfare and school medical services.

DISCUSSION

CHROMOSOME NUMBERS IN MAMMALS AND MAN

HAVING had occasion recently to survey the chromosome numbers in Marsupials and placental mammals, a group in which many new and accurate counts have been made in recent years, it seems worth while pointing out some of the relationships which emerge. In Marsupials the most common diploid number is 22, although certain genera have 12 or 14. On the other hand, the armadillo (Edentata) has 60, which is also the usual number in Ungulates so far as known, the horse, cattle, yak, goat and sheep all having this number. In domestic pigs and in peccaries the known numbers are respectively 38 and 30. In Carnivora the numbers range from 34 in the fox to 78 in the dog. This suggests the possibility that in dogs doubling has taken place through crossing under domestication. In Rodentia the numbers are variable, 40 and 42 being frequent numbers in mice and rats, while the squirrels appear to range from 28 to 62, and even higher numbers have been counted in certain genera of rodents. The single species of bats whose chromosome number has been determined has 48. This number is found in all the Primates hitherto studied, that is the Rhesus monkey, chimpanzee and man, with the exception of a brown Cebus monkey having 54.

Although many counts remain to be made, certain tendencies are already clear. The placental mammals have numbers which are generally more than double those found in the marsupials, the ungulates having generally higher numbers than the primates. The evolutionary tendency has clearly been to an increase in chromosome numbers. In plants such increases in numbers have frequently been through allo- or autopolyploidy, and this can be confirmed by a study of the nucleoli.[1] It is still uncertain in how far the number of nucleoli in animals can be used as an index of the number of sets of chromosomes.

It was formerly assumed that polyploidy in animals would upset the sex chromosome mechanism, although I predicted[1a] that, in dioecious plants such as Salix, chromosome doubling would be followed by a process of readjustment of the sex chromosomes, so that the sex balance would be maintained. The more careful papers on mammal cytology have all described an unequal XY pair, or rarely an XO condition which, however, can hardly be regarded as certainly authenticated in any case. In dioecious plants, where the conditions are essentially similar to those in most animals, it turns out that doubling of the chromosomes does not necessarily have the effect predicted. For example, tetraploid forms of *Melandrium album*, produced by heat treatment, had in the male 2n = 44 + XXYY and in the female 2n = 44 + XXXX.[2] When these 4n males and females were crossed together, the plants (with 44 + XXXY) were not intersexes but pure males, apparently owing to a strong dominant factor for maleness in the Y-chromosome. Even 4n × 2n gave triploid males and females with 2n = 33 + XXX (♀), and 2n = 33 + XXY (♂), respectively. Blakeslee[3] independently showed that in dioecious Melandrium when the chromosomes are doubled the species ultimately settles down to a balanced tetraploid condition with equal numbers of male (XXXY) and female (XXXX) individuals. Similarly, tetraploidy was induced in *Carica papaya* by the use of colchicine.[4] Of the 4n plants so obtained, 9 were ♀, 4 ♂, 1 ☿. As might be expected, the sex balance differs from one species to another.

Chromosome doubling in the higher mammals is therefore by no means ruled out, and it is possible that the 48 chromosomes of the primates and man may be a secondary tetraploid number. This might help to explain the relatively frequent occurrence of intersex conditions in man. Various critical studies of the sex chromosomes in man, *e.g.*, by Painter (1923) and Koller (1937),[5] indicate that the X and Y bear satellites and therefore probably produce the nucleoli. A study of the nucleoli in human spermatogenesis should furnish evidence on the possible presence of more than one pair of nucleoli, but as the number 48 is evidently an ancient one, it is probable that in man (as in some varieties of rice) the mutational loss of a pair of nucleolus-producing loci will have occurred long since, leaving only one pair.

That chromosome evolution is going on in man is indicated by the fact (Koller, 1937) that a man descended in the second generation from a cross between a Scotswoman and a Frenchman was heterozygous for an inversion in a chromosome segment. The study of meiosis in racial hybrids may therefore disclose chro-

[1] See Gates, *Bot. Review*, 8: 337–409, 1942.

[1a] Polyploidy and sex chromosomes. *Nature*, 117: 234. 1926.

[2] M. Westergaard, *Dansk. Bot. Arkiv.*, 10: 1–131, 1940.

[3] Effect of induced polyploidy in plants, *Amer. Nat.*, 75: 117–135. 1941.

[4] J. D. J. Hofmeyr and H. van Elden, *S. Afr. Jour. of Sci.*, 38: 181–185, 1942.

[5] T. S. Painter, *Jour. Exp. Zool.*, 37: 291–336, 1923; P. C. Koller, *Proc. Roy. Soc. Edinb.*, 57: 194–214, 1937.

matin rearrangements, and possibly also (as in Drosophila) the order of their occurrence, as an aid in the study of racial relationships.

If mammals, like plants, retain for long periods their extra nucleoli arising through polyploidy or any other form of duplication of the nucleolus-producing chromosomes, then the nucleoli should prove a valuable aid in tracing phylogenies in this group of animals. It is now well known that in insects polyploidy in the fat bodies and other organs is a general feature of the ontogeny. From the work of Jacobi, Wermel and others, in which the nuclei of the liver and other organs fall into a geometric series of volumes, it is evident that something of a similar kind, perhaps polyteny, may take place in human ontogeny. Polyploidy in animals may thus prove to be much more wide-spread than we have been accustomed to suppose.

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LONGEVITY OF FOWL SPERMATOZOA IN FROZEN CONDITION[1]

PRESERVATION of life in monocellular organisms by storage at low temperatures offers many possibilities in biological studies requiring long-time storage. As cited by Luyet,[2] Brehme reported that cholera vibriones survived continuous freezing for 57 days at $-1°$ C to $-16°$ C and Prucha and Brannan, also cited by Luyet, isolated *Bacillus typhorus* from ice cream kept for 20 months at $-20°$ C. Jahnel[3] reports that some human spermatozoa resumed motility after having been held at $-79°$ C for 40 days and Shettles[4] reports the resumption of motility of human sperm after 70 days' storage at $-79°$ C.

A technique for preserving chicken spermatozoa by storage at low temperatures has been described by Shaffner, Henderson and Card.[5] Results from experiments using slight modifications of the original technique indicate that time is not an important factor in the retention of motility within the first year, when fowl semen is held constantly at the temperature of solid CO_2. Spermatozoa have been maintained at a temperature of dry ice ($-79°$ C) for 14 months. Little if any difference could be noted in the percentage of cells that regained motility between samples thawed immediately after freezing or those thawed after 14 months storage.

Unmated hens producing infertile eggs were inseminated with semen that had been frozen at $-79°$ C and thawed an hour later. Of 48 eggs produced by these hens after insemination 12 were fertile. However, in no case did the resulting embryonic development proceed for more than 10 to 15 hours, as determined macroscopically.

C. S. SHAFFNER
POULTRY DEPARTMENT,
PURDUE UNIVERSITY

1 Journal paper No. 20, Purdue University Agricultural Experiment Station.
2 B. J. Luyet, Life and Death at Low Temperature, *Biodynamico*, Normandy, Missouri, 1941.
3 F. Jahnel, *Klin. Wchnschr.*, 17: 1273, 1938.
4 L. B. Shettles, *Am. Jour. Physiology*, 128: 408, 1940.
5 C. S. Shaffner, E. W. Henderson and C. G. Card, *Poultry Science*, 20: 259, 1941.

THE ERADICATION OF NUT GRASS

FOUR years ago E. V. Smith and E. L. Mayton[1] reported that they were able to control nut grass by "plowing or disking at intervals of three weeks or less during two consecutive growing seasons." As the writer's[2] laboratory experiments have shown that nut grass is killed by 1 N chlorate or 2 N thiocyanate solutions, it seemed worth while to see if the chemical method would not offer a cheaper and quicker way of control of nut grass than that suggested by Smith and Mayton.

The experiments were performed during the spring and summer of 1940 on plots which contained 250–500 plants of nut grass per square meter. One liter of solution was applied per square meter. The chlorate ion was applied in the form of sodium chlorate, the thiocyanate ion in form of calcium thiocyanate. The author is very much obliged to the American Cyanamide and Chemical Corporation, New York, for the supply of the calcium salt. The results compiled in Table I show clearly that the result of the field experiments were less satisfactory than those of the laboratory experiments. One fifth to one fourth of the plants were still surviving after 20 days. Though some of them were very weak and died within 10 more days, still about one tenth of the weeds survived and were able to repopulate the field. Also a repeated application of the herbicide would not kill them.

TABLE I

Substance	Normality	No. of experiments	Percentage of plants surviving at 20th day	Percentage of plants surviving at 30th day
ClO_3^-	2	3	26	12
CNS^-	2	2	15	10
CNS^-	1.5	2	15	..
CNS^-	0.7	2	40	22

The reason for this incomplete control was the same as for the failure of simple tillage as a method of eradication of nut grass: the bulbs, which are the most resistant part of the plant, are relatively deep below the surface and can not all be reached by the weed killer if its solution is applied to the surface only. In May and July, 1940, further experiments in neighboring plots were, therefore, conducted in this

1 *Jour. Am. Soc. Agron.*, 30: 18, 1938.
2 *Rev. agr., ind. y com.*, Puerto Rico, 33: 180, 1941.

way: The field was first turned over to a depth of 5 to 6 inches and then treated with the solution of the herbicide. When 2 N chlorate solution was applied this way at a rate of one liter per square meter, only 16 plants (*i.e.*, 4 per cent. of the control) were seen per square meter after 20 days. In analogous experiments with one liter of 2 N thiocyanate per square meter the number of plants was reduced to 1 per cent. or less of the control within 90 days, so that the eradication was virtually complete. Two to three months after these experiments the plots have been used again for the cultivation of corn, tomatoes and cayenne pepper without any damage to the crops. In the two following years of cultivation no new infestation with nut grass has been observed in these fields.

Hence, the simultaneous application of tillage and a 2 N thiocyanate solution seems an equally effective and cheaper way of controlling nut grass than the frequent plowing, as recommended by Smith and Mayton.

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SAN GERMÁN, P. R.

THE DUTY OF THE ENTOMOLOGIST[1]

IT has been customary in France to designate certain scientific societies, organized without reference to commercial profit, as societies of public utility. Now, in the midst of war, we have to ask, Is the work of entomologist of public utility, and if so, in what respects? To-day I received from the Royal Entomological Society of London a large package of highly technical papers, just published, with many excellent illustrations. It would, I am afraid, have proved difficult to get those papers published in the United States, or if they were, the authors would have been expected to pay for the figures. For some time, Professor Ferris of Stanford University has been bringing out a fully illustrated treatment of the scale insects or Coccidae. Although this group of insects has great economic importance, Ferris had to put up a large sum of money to get the last part published and he states that he can not continue the work on that basis. It appears probable that we shall be deprived of a work which would be of very great value, not only now, but in the years to come.

In wartime the standard of values changes. The ordinary scientific worker, such as the present writer, has been accustomed to carry on researches looking toward a more or less remote monograph, which we may never live to see. We have regarded our work much as a mother regards her child: always interesting, very dear to us, always growing, and we hope, destined to mature and do things in the course of years. But in wartime we need results to-morrow, something which can be applied without delay to the existing situation. It is not altogether easy to adjust our minds to the new conditions, but we must do it. Just now I am much interested in the appointment, by both army and navy, of numerous entomologists who will accompany the various units to different parts of the world, and will have to ascertain the presence of any insects or other arthropods which may convey disease organisms to the troops. I am sure they will save many lives and reduce the incidence of malaria in particular. When things have become more stabilized, it is proposed that the entomologists who have to stay at home shall nevertheless have an important service to give, that of supplying information and getting species identified. Already it is possible to give some advice of consequence. Thus in New Caledonia they have neither *Anopheles* nor malaria. In the New Hebrides, not far away, they have both. Under war conditions it might be possible to accidentally carry *Anopheles* to New Caledonia, and the results might be disastrous. There are various other similar cases.

Now it will be noticed that the rapid work of the war-time entomologist is only possible because of the patient labors of earlier workers, extending through many years. This work would be more efficient if more such work had been done, but since it was clearly recognized that insects were connected with disease, the amount of study given to such insects is tremendous, and is published in many splendid memoirs. So, also, the insects affecting the crops have been intensively studied, though not yet sufficiently.

One thus comes to the conclusion that although we must largely concentrate on matters which are of immediate urgency, the relatively slow march of science should not be halted. It is quite right to urge, as a war policy, that we should reduce the use of luxuries, but it does not seem right to classify scientific work under this head. The research work of entomologists, in any country, involves only a small number of workers, and the publication facilities which they need are, as compared with other types of publication, exceedingly small. There should, indeed, be a stepping-up of research, with increased rather than diminished facilities. This not only for economic reasons, but as promoting a sane outlook on life.

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[1] In 1927, my wife and I were in central Siberia, working under the auspices of the Geological Committee of the U.S.S.R. At that time there were, I believe, about 200 trained geologists exploring all parts of the vast Russian dominions, mapping the country and recording the deposits of coal, iron and various minerals. If I had suggested at that time that the work of these geologists would, fifteen years later, be of vital importance to the United States, the idea would have seemed too fantastic to be worth discussing.

SCIENTIFIC BOOKS

TEXT-BOOKS ON COLLOIDAL CHEMISTRY

A WRITER, recently commemorating the centenary of a famous volume, remarked that no science rises above its text-books. I sincerely hope that this is not true, but if it is true, then we are under strict obligation to see to it that our text-books maintain a high standard. In many ways, this is a difficult if not impossible task, but, through cooperative work, it is at least possible to prevent the repetition from text-book to text-book of errors to which critics have repeatedly called attention. I am told that in past years some text-books in zoology carried the obviously erroneous statement that the erythrocyte of the camel was the only known nucleated mammalian red blood cell. The error persisted for thirty-five years until some one had the ingenious idea of going to the zoo, getting some camel's blood and looking at it. Of course, he found that the cells, like all other mammalian red blood cells, were without nuclei.

It is about thirty-five years since Wolfgang Ostwald presented his "emulsoid" classification of colloids, and it is nearly twenty-five years since Hatschek stated that the emulsoid nature of jellies is untenable. It is now more than a dozen years since I called attention to the confusion which the term emulsoid has caused, and pleaded for its rejection.

A new biological text has just come into my hands. The author states that "protoplasm is an emulsion or, technically, an emulsoid," and that it may exist as a sol or gel. Aside from the fact that protoplasm is only superficially an emulsion, and the fact that the recognized technical name of an emulsion is not emulsoid, there is the further fact that a pure emulsion can not form a gel.

If the author of a biological text turns to a book on physical chemistry he may find the matter accurately presented, as it is in Getman and Daniels, but very briefly so and without a colloidal flavor. There will probably be no mention of jellies. If he turns to a volume on colloidal chemistry or biochemistry he may or may not find the matter correctly put. Thus, the lone statement that "emulsoid usually emphasizes a combination of the phases" is but feebly true and misleading.

Gortner enumerates the customary eight classes of colloids, and under liquid-in-liquid systems discusses gelation and the properties of lyophilic colloids in general. He there makes no mention whatever of the true liquid-in-liquid systems, the emulsions, but later under a separate heading takes them up. To call gelatin a liquid-in-liquid system is enough to coagulate the blood of any living member of that noble assemblage of colloid chemists which includes such familiar names as Donnan, Ellis, Hatschek, Freundlich, Proctor and Wilson, and to these I feel confident that I can add Staudinger, Sheppard, Kraemer and Williams.

Liquid-in-liquid systems are emulsions, and if they must be below the limit of microscopic vision they can be made so. It was Donnan and Ellis who pointed out that pure colloidal emulsions are model *suspension* colloids, and therefore of the same class as solid-in-liquid systems, such as colloidal gold. Gelatin is but feebly related to the suspensions, so little so that Duclaux in 1925 excluded the solid and liquid suspensions from his book on "Les Colloids," which shows that all along some workers have understood and some have not.

Classifying gelatin as a liquid-in-liquid system is the kind of reasoning which leads to confused situations such as the attempt to distinguish between emulsions, emulsoids and jellies, by defining emulsoids as stabilized emulsions. This is probably an effort to explain why emulsions such as milk and latex coagulate. The misunderstanding is a common one and is due to the fact that natural emulsions are not pure systems. Milk is certainly an emulsion, but it just as certainly contains casein, and when milk curdles it is the casein that does so, the emulsion or butter-fat having nothing whatever to do with it.

The same situation arises in connection with protoplasm. It is impossible to characterize protoplasm as this or that kind of system except by some such all-inclusive term as polydispersoid, which tells very little except that protoplasm is exceedingly heterogeneous.

I have never been a strong advocate of precise terms and final definitions. A name too often takes the place of an idea, frequently to obscure an erroneous idea. Yet, a language consists of words and only through them can we express our thoughts.

Relatively little attention has been given to colloidal nomenclature. Rheologists have made a thorough study of the terms of their science, and the anatomists and taxonomists hold conventions for this sole purpose. It is twenty-five years since Thomas wrote that the use of the term gel "is deplorably loose and confusing." I doubt if its use is any more specific to-day.

In many instances the loose use of an expression is not serious. Thus, "colloidal solution," deplored by some, is much used by others. Zsigmondy thought it not inaccurate. It at least does little harm because of the adjective colloidal. Quite other, however, is it with that *bête noir,* the word "emulsoid." In order that this troublesome term may once and for all be thrown out, and also that other erroneous or misleading words and ideas may be eliminated or corrected, I suggest that the Colloid Chemical Division of the American Chemical Society and the Colloid Commit-

tee of the National Research Council officially adopt an at least tentative nomenclature.

Not only terms and definitions should be given consideration but some antiquated text-book ideas as well. One which I should like to have dealt with is the following. Several years ago I was an "expert witness" in a legal trial having to do with the harmful effects of sulfuric acid "fumes," or mist, set free in a commercial plant. The opposition pointed out that there could be no fumes because of the very low vapor pressure of sulfuric acid, to which all agreed, but I held it was mist, and not fumes, with which we had to deal. The opposition, still preferring to condense fumes which were not there rather than disperse the liquid acid by spattering, insisted on the presence of dust in order to produce mist, but owing to wet floor and walls no dust could be present. Their contention that dust must be present was based on the old text-book statement that atmospheric vapor is condensed on dust particles, forming colloidal droplets which, suspended, constitute mist. Though the discussion seemed to me irrelevant, for acid was being dispersed and not fumes condensed, I nevertheless answered the question on the need of dust particles in the negative, and was adjudged in error. The "expert witness" of the opposition was not a colloidal chemist, so, of necessity, had accepted what he had read in colloidal text-books.

Texts are so often assumed to be a collection of facts, when, actually, they are a collection of opinions. That mist results from the condensation of atmospheric moisture on the surface of dust particles is an opinion that I have always doubted. It persists as a text-book hypothesis, a relic of the early days of colloidal chemistry. There is no reason why the aggregation of atmospheric moisture should necessarily take place only under special conditions requiring nuclei, when so many other forms of colloidal and molecular aggregation take place without nuclei. Nuclei are not necessary for the precipitation of solutions, the formation of colloidal suspensions from matter in solution, the production of gels by coagulation of colloidal dispersions and the agglutination of living cells in suspension.

As in the case of salts crystallized out of solution, nuclei may hasten the process, but they are not necessary. Bancroft states that dust is not necessary for the production of mist, though nuclei cause the formation of mist at lesser supersaturations than would ordinarily be necessary.

We move on rapidly to an understanding of profound and far-reaching problems and leave many simpler questions just where they were in the early days of our science.

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SOCIETIES AND MEETINGS

THE JUNE SPECTROSCOPY CONFERENCE AT THE UNIVERSITY OF CHICAGO

FROM June 22 to 25 a conference was held at the University of Chicago, consisting in a series of symposia on various pure science aspects of spectroscopy. The program and the participants ranged over the fields of chemistry, physics and astronomy. Papers were presented by thirty invited speakers at eleven sessions, including some discussion papers prepared in advance. The estimated total attendance was between 250 and 300. The papers and discussion are being published as the April–July number of *Reviews of Modern Physics*.

After an introduction by the writer describing the background and purposes of the conference, the first morning session, on Monday, June 22, consisted in a symposium by physicists on "Spectroscopic Methods." Henry G. Gale, of the University of Chicago, who had agreed to act as chairman at this session, was prevented from doing so by a recent operation. W. F. Meggers, of the Bureau of Standards, W. E. Williams, of University College, London (now in Pasadena), and H. G. Beutler, of Chicago, were the chief speakers in discussions on standard wave-lengths and the concave grating. The use of the isotope 198 of mercury, obtained by transmutation of gold, as the source of a new primary standard of wave-length was proposed. The afternoon session was a symposium by astronomers and astrophysicists on "The Spectra of Comets." The speakers were N. T. Bobrovnikoff, Perkins Observatory; G. Van Biesbroek, Yerkes Observatory; A. McKellar, Dominion Astrophysical Observatory, and P. Swings, Yerkes Observatory. In addition, a paper was communicated by G. Herzberg, professor of physics at the University of Saskatchewan, in which for the first time a polyatomic molecule, the CH_2 radical, was identified as giving rise to cometary spectra. This was particularly interesting in that the spectrum of this important radical had not hitherto been known. Since the conference, Dr. Herzberg has reproduced the cometary CH_2 spectrum in a laboratory discharge tube. At the Monday evening session, four physicists who have worked in the field took part in a very satisfying symposium on "Atomic Beam Spectra." They were K. W. Meissner, Purdue; R. A. Fisher, Northwestern; J. E. Mack, Wisconsin, and W. E. Williams, Pasadena.

The Tuesday morning program on "The Earth's

Atmosphere and the Constitution of the Planets" was made up of papers by F. L. Whipple, Harvard Observatory; C. T. Elvey, McDonald Observatory, and R. Wildt, Princeton, with O. R. Wulf, Chicago, as chairman. The afternoon session on "Atomic and Molecular Spectra" returned to the physicists with papers by W. F. Meggers, J. E. Mack and G. Herzberg. Dr. Meggers showed how the very complicated spectra of the rare earth metals are at last being unravelled. The conference dinner on Tuesday evening was followed by brief talks by A. H. Compton, O. Struve, K. K. Darrow, J. Franck and W. F. Meggers. Professor Struve spoke on "Astronomy Faces the War."

On Wednesday and Thursday the program dealt mainly with the spectra of increasingly complicated molecules, with chemists and physicists taking part. The Wednesday morning symposium, with four physicists participating, was on "Triatomic Spectra." The speakers, E. F. Barker, Michigan, R. S. Mulliken, Chicago, S. Mrozowski, Chicago, and H. H. Nielsen, Ohio State, discussed both infrared and ultraviolet spectra. In the afternoon, physical chemists and a physicist took part. The speakers were W. H. Rodebush, Illinois; Miss H. Sponer, Duke; A. L. Sklar, Catholic University, and A. Turkevich, Columbia, with K. F. Herzfeld, of Catholic University, as chairman. The discussion referred largely to ultraviolet spectra of benzene and its derivatives. Professor Rodebush mentioned that the absorption spectrum of rubber changes on stretching. At the evening session on "Spectra of Dye Molecules," after an introduction by W. G. Brown, Chicago, L. G. S. Brooker, Eastman Kodak Research Laboratory, organic chemist, presented empirical generalizations based on a wealth of examples, and A. L. Sklar, presenting work by himself and K. F. Herzfeld, showed that these can be explained remarkably satisfactorily by quantum mechanics.

On Thursday morning, Miss E. P. Carr and Miss L. W. Pickett, of Mount Holyoke, described their extensive work on diene spectra (including butadiene); R. S. Mulliken and Mrs. C. A. Rieke discussed some quantum-theoretical studies on benzene and other molecules, and Mrs. M. Goeppert-Mayer, Columbia, reported the results of quantum-mechanical computations on the Wurster salts; G. W. Wheland, Chicago, was chairman. The Thursday afternoon and evening sessions were on "Cooperative Spectra," with J. Franck and P. Pringsheim, of Chicago, as chairmen. S. E. Sheppard, Eastman Kodak Research Laboratory, presented much interesting material about dye spectra. E. Rabinowitch, Massachusetts Institute of Technology, and S. Freed, Chicago, discussed the spectra and structure of ion complexes. P. Pringsheim, Chicago, described experiments on absorption and phosphorescence of potassium-thallium-halide phosphors, carried out in Belgium and Berkeley. G. N. Lewis, who had expected to give a paper, was prevented from coming by last-minute developments.

In the introduction on the first day, the writer described the background and purposes of the conference, then expressed the belief that the maintenance of at least a minimum of fundamental research activity even in those fields of pure science having no obvious connection with the war effort, is wise national policy. This talk, with some omissions and changes, was as follows:

Viewed broadly, spectroscopy is a very large subject, with ramifications in many directions in physics, astronomy, chemistry and biology. The data of modern astrophysics, for example, are obtained very largely through the use of the spectroscope.

In recent years, a number of very successful conferences have been held which have been devoted primarily to the practically very important field of the application of spectroscopy in spectrochemical analysis. Less attention has been given lately to spectroscopy as pure science.

It therefore seemed to us that the time was ripe for a conference on spectroscopy to present the broad picture of spectroscopy as pure science.[1] We also thought it would be desirable to further better acquaintance and a stronger consciousness of underlying unity among those using spectroscopy in different fields of pure science. We therefore planned a conference to consist of a number of symposia, each in a special field connected with or based on spectroscopy, and so arranged as to cover each day a considerable range of subjects. In this way, we hoped that visitors would find some familiar things and also other less familiar things to interest them and to bring them into contact with others in different fields. For instance, the astrophysicists might exchange ideas with the pure spectroscopists or with those interested in the structure of atoms or molecules; the ultraviolet spectroscopists with the infrared spectroscopists; or the chemical physicists with the organic chemists interested in spectra.

Last winter we were for a time in doubt as to whether to go ahead with our plans. There were two questions. With so many scientists going into war activities, it might have been that too few could find the time to come. The second question was that of the relative importance of pure science in wartime as compared with science applied directly to winning the war.

[1] The committee on the conference consisted of O. Struve (astronomy); J. Franck and W. G. Brown (chemistry) and R. S. Mulliken (physics).

As far as speakers were concerned, we soon found that most of those whom we approached were able and willing to come. This to a large extent answered the first question. It also helped in answering the second. The fact that a large proportion of the speakers were engaged in war work, some very extensively, indicated that they agreed with us as to the importance of maintaining the development of pure science where possible.

I think we are all convinced that pure science research is a matter of very great long-run value to the nation. Granting this, there are two reasons why it is important now to keep it going. In the first place, we do not know how long the war will last; there is enough of a probability that it will last for a long time, so that weight should be given to activities of long-run importance even for their possible value in winning the war. In the second place, weight also should clearly be given to pure science so that the nation's scientific foundations will be strong when peace finally comes.

There are some fields of pure science which are so fortunate as to have had their development greatly accelerated as a direct part of the war program. Here the path is clear. In other fields, however, which are no less important for the progress of science in the long run, the effect is reversed. Although, in general, priority must be given to the fields of direct short-term value, nevertheless I am convinced that workers in the long-term fields should feel that they too are making a valuable contribution to the national effort by carrying on their work as effectively as possible.

Quoting a letter received this spring from a British colleague, "I am so sure that above all we must see that some fundamental research tradition is preserved at our universities. There is a danger here in Britain of it stopping, through sheer pressure of work. I hope that it won't stop with you in America. In the last war we lost about 15 years in our British universities through it; we must not let that happen again."

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SPECIAL ARTICLES

GROWTH OF CANCER TISSUE IN THE YOLK SAC OF THE CHICK EMBRYO

BY the simple process of injecting a suspension of tumor cells directly into the yolk, we have succeeded in growing cancer tissue in the yolk sac of the developing chick embryo. Tumors up to 3.5 grams in size have been produced in this manner with an initial inoculation of .05 gram of tumor tissue.

It has been known for some time that cancer tissue can be grown on the chorio-allantoic membrane of the developing chick embryo.[1] This technique, however, has proved to be somewhat limited in its scope, since it involves removing a piece of the egg shell and the depositing of the tumor tissue directly on the chick membranes. This effects considerable interference with the embryo and the mortality rate among eggs so treated is about 65 per cent., according to Stevenson.[2] Further, the initial inoculation must be small (.003 to .005 grams), and large tumors can not be produced regularly because they are likely to interfere with the growth and development of the chick.

In the present method each egg can be inoculated in a few seconds, the mortality rate is little more than that of untreated eggs, and 100 per cent. takes can be expected.

Mammary carcinoma transplants of the DBA and C_3H strains of mice were used. Moderate size tumors (1 to 2 grams in weight) were dissected out aseptically and squeezed through muslin cloth so as to disperse the cancer tissue. This material was diluted with saline solution to the extent where each ml of suspension contained about .2 gram of tumor tissue. Tumors which had external lesions and were infected could not be used as donors. It is well known that tumor transplants in mice may grow in an apparently normal manner even when some bacterial infection is present. Such tumor material naturally could not be used for injection into the egg yolk. The presence of necrotic tissue in the injected material also resulted in the death of the embryo.

Fertile eggs after incubation for 4 or 5 days at 38° C were used for inoculation. A needle-sized opening was made in the shell area over the air sac and .25 ml of the tumor suspension was injected hypodermatically into the yolk, using a 20-gauge needle 1¼ inches in length. The opening in the shell was then sealed over with cellulose tape. It has been our experience that the egg can accommodate a much heavier inoculation of tumor tissue.

After inoculation, the eggs were incubated at 37° C for 12 or 13 days or until the total incubation time was 17 days. The injected tumor tissue became attached to the inner wall of the yolk sac from which it obtained its blood supply. The bulk of the tumor, which tended to conform in appearance with the mouse-grown variety, grew down into the yolk of the yolk sac cavity. In this position there was plenty of room for growth without mechanical interference with the embryo mem-

[1] J. B. Murphy, *Jour. Am. Med. Asn.*, 59: 874, 1912.
[2] H. N. Stevenson, *Jour. Cancer Research*, 3: 63, 1917.

branes. Tumors grown in this manner grew readily when transplanted back into mice. As long as care was taken to obtain clean tissue free of yolk and other extraneous materials the takes and growths in the mouse appeared unchanged from its original behavior in these respects.

It appeared, however, that cancer cells were also diffused through the yolk substance, since subdermal injection into a mouse of untreated yolk from cancer-inoculated eggs was sufficient to produce a tumor of the same type as the donor tissue for the egg.

Histological sections revealed healthy-appearing cancer cells with numerous mitoses in progress. The supporting stroma was supplied by the yolk sac membrane.

For many problems in cancer research this new method of growing cancer tissue should be of value. The tumors so produced are contained in a relatively stable biological system which at the same time is open to some manipulation.[3] Further, since the stroma is furnished by the chick tissue, different types of tumors can be studied against a common background.

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THE EFFECT OF 11-DESOXY-17-HYDROXYCORTICOSTERONE ON RENAL EXCRETION OF ELECTROLYTES[1]

IN an earlier report[2] data were presented which indicated that adrenal steroid compounds possessing a hydroxyl group on C_{17} in the presence of an oxygen atom on C_{11} stimulated the renal excretion of sodium and chloride in normal dogs in contrast to the well-known "sodium and chloride-retaining" effect of 11-desoxycorticosterone, corticosterone and dehydrocorticosterone. At that time it was not possible to determine the physiological effect of the addition of the hydroxyl group on C_{17} in the absence of an oxygen atom on C_{11} because of inability to obtain crystalline 11-desoxy-17-hydroxycorticosterone (Substance "S"; Reichstein). Recently Professor T. Reichstein, of Basel, succeeded in providing us with a sample of this compound which, when tested in a normal dog, indicated that it belonged to the group of compounds possessing "sodium and chloride-retaining" property (Table 1). The addition of a hydroxyl

TABLE 1

EFFECT OF THE INJECTION OF 25 MG OF 11-DESOXY-17-HYDROXYCORTICOSTERONE. (SUBSTANCE "S," REICHSTEIN)

24-hour period	Urine volume	Sodium	Chloride	Potassium	Inorganic phosphorus	Total nitrogen	Body weight
	cc.	m.eq.	m.eq.	m.eq.	mg	gm	kg
Control .	490	63	54	20	570	10.3	12.8
Treated .	390	34	38	14	480	10.1	12.9
Control .	470	55	50	16	520	11.1	12.9
Control .	420	58	54	18	450	10.6	12.8

group on C_{17}, however, definitely reduced the "sodium and chloride-retaining" potency of desoxycorticosterone.

It is of interest to note that whereas the addition of a hydroxyl group on C_{17} to a compound which possessed a very striking "sodium and chloride-retain-

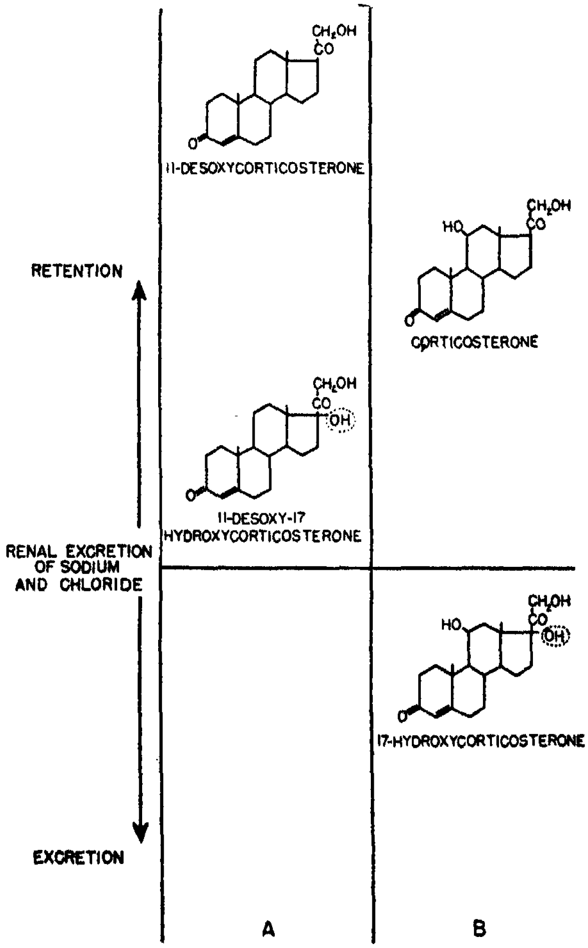

FIG. 1. Adrenal steroids: The relation of changes in chemical structure to the renal excretion of sodium and chloride. Compounds in column "A" do not possess carbohydrate-regulating-activity whereas compounds in column "B" do.

[3] A. Taylor, J. Thacker and D. Pennington, SCIENCE, 94: 542, 1941.

[1] This study was aided by a grant from the Committee on Research in Endocrinology, National Research Council.

[2] G. W. Thorn, L. L. Engel and R. A. Lewis, SCIENCE, 94: 348, 1941.

ing" property, *i.e.*, desoxycorticosterone, resulted in the formation of a compound with relatively low "sodium and chloride-retaining" potency, the addition of a hydroxyl group on C_{17} to a compound which initially possessed moderate "sodium and chloride-retaining" potency, *i.e.*, corticosterone, resulted in the formation of a compound in which all "sodium and chloride-retaining" effect had disappeared. In this latter instance, the new compound actually facilitated sodium and chloride excretion (Fig. 1).

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CHILDREN'S SPEECH

IN a recent note about my studies (SCIENCE, December 26, 1941) John B. Carroll stated that he had tried without success to study mathematically the distribution of words in children's speech. The readers of SCIENCE may therefore be interested in the nature of the results of a fairly extensive mathematical investigation that I have been conducting on this subject.[1]

In Fig. 1 is presented the Rank-Frequency distribution of the different ranked words (X) with their respective frequencies (Y), with straight lines connecting successive points, of an aggregate of approximately 24,000 words dictated into an Ediphone by a girl during the six weeks preceding her fifth birthday, as reported by R. S. Uhrbrock.[2]

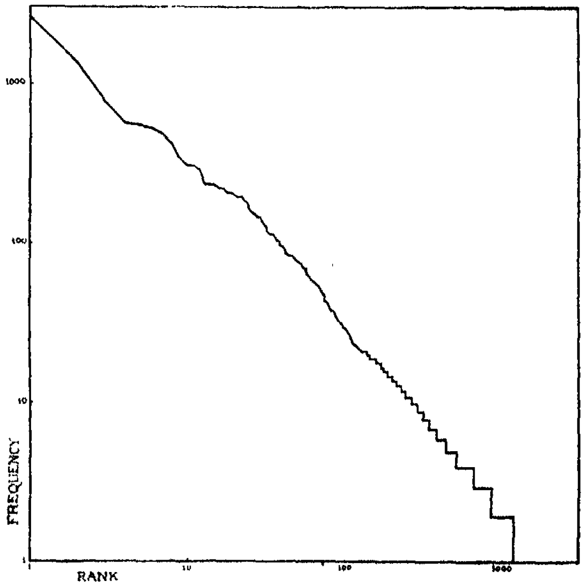

FIG. 1. The rank-frequency distribution of *ca.* 24,000 running words of a five-year-old girl recorded by R. S. Uhrbrock.

Dr. Uhrbrock put at my disposal the manuscript not only of the above material, but also of the dictations of the same girl made on or about her 6th, 6½th and 7th birthdays. The results of five samples of 2,000 words each from the 5-, 6½- and 7-year material, and of two samples of the same length from the less extensive 6-year material are presented in Table I, where the closeness of the calculated values to the theoretical slope, -1, is apparent. The best lines of X's and of Y's were calculated by least squares, and the error is the root-mean-square error of the deviations from the best line of Y's.

TABLE I

RANK-FREQUENCY DISTRIBUTION OF THE UHRBROCK RECORDINGS OF THE SPEECH OF A GIRL

Sample number	Age	Length of sample (words)	No. ranks (X)	Best X-slope (negative)	Best Y-slope (negative)	Error (Y)
5 yrs.	1	2,002	513	.97	.92	.086
	2	2,000	501	.95	.93	.055
	3	2,003	496	.96	.92	.077
	4	2,000	484	.97	.94	.078
	5	2,000	475	1.00	.95	.091
6 yrs.	1	2,000	466	1.00	.96	.080
	2	2,000	459	.99	.96	.081
6½ yrs.	1	2,000	467	.99	.95	.082
	2	2,000	500	.97	.93	.077
	3	2,000	413	1.02	.99	.074
	4	2,000	404	1.02	.99	.074
	5	2,000	476	.96	.93	.069
7 yrs.	1	2,000	437	1.02	.99	.074
	2	2,000	440	1.01	.98	.074
	3	2,000	398	1.04	1.01	.076
	4	2,000	457	.98	.95	.070
	5	2,000	487	.95	.92	.073

In addition to the above Uhrbrock material I have similarly analyzed the words of the extensive speech-material ranging from 22 through 59 months as collected and reported by M. S. Fisher[3] and as generously made available to me for the above purposes by Dr. L. H. Meek, director of the Child Development Institute of Teachers College, Columbia University. Though the 72 samples examined vary considerably in size and in best Y-slope, nevertheless the median slope is -1.02. In discussing the above material in greater detail in a future publication,[4] I shall present quantitative information on the general relationship between the size of sample and slope[5] and also the positive correlation

[3] John D. Archbold fellow in medicine.

[1] This investigation was made possible by grants from the Milton fund and from the Committee on Research in the Social Sciences at Harvard University. I here acknowledge the help of my wife and of my research assistants, Miss Inez Randall and Dr. Sydney Fairbanks.

[2] R. S. Uhrbrock, *Ed. Research Bull.*, 14: 85–97; also *Jour. Ed. Psychol.*, 27: 155–158.

[3] M. S. Fisher, *Child Development Monograph* No. 15, New York, 1934.

[4] Chap. III of "The Principle of Least Effort" now in preparation.

[5] G. K. Zipf, "The Psycho-Biology of Language," p. 44, Boston, 1935; *Jour. Psychol.*, 4: 239–244; *Psychol. Record*, 2: 347–367.

between age of child and size of the constant, C (in terms of R F = C), together with an analysis of its possible bearing upon the problem of intelligence and of the general meaning of bends from the straight line.

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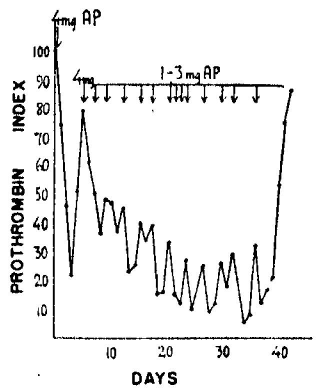
SCIENTIFIC APPARATUS AND LABORATORY METHODS

HYPO-PROTHROMBINEMIA PRODUCED BY 3,3'-METHYLENEBIS (4-HYDROXYCOUMARIN) AND ITS USE IN THE TREATMENT OF THROMBOSIS

PROTHROMBIN is formed in the liver, and it can be assumed that one or more enzymes are responsible for its formation. The activity of the enzymes is dependent on the presence of vitamin K, which may possibly be a prosthetic group attached to an active protein. On this assumption, the administration of a compound that could displace vitamin K and thus inactivate the enzymes would produce a hypo-prothrombinemia and thus could be used to reduce the incidence of post-operative thrombosis and thrombosis from other causes. Several naphthoquinone derivatives were tried first but without success.

The work of Quick,[1] Schoefield[2] and Campbell *et al.*[3] showed that the ingestion of spoiled sweet clover (*melilotus albus*) by cattle and rabbits caused a hypoprothrombinemia. The active agent was isolated by Stahmann *et al.*[4] and shown to be 3,3,[1]-methylenebis (4-hydroxycoumarin). This compound, called AP (antiprothrombin), was supplied by the Ferrosan Company of Malmö, Sweden, and used in the following experiments.

When AP is given per os to rabbits in a dose of 3–4 mg/kg the prothrombin index (Quick) was lowered for 1–2 days to between 10–20. (Similar effects have recently been reported by Overman *et al.*[5]). This effect was reproducible and reversible. Fig. 1 shows that the prothrombin index rapidly returns to normal even after almost daily administration of the drug for a month. No toxic effects were seen on the circulation, respiration, intestines, liver, kidney, heart and the composition of the blood. The lethal dose is 250 mg/kg for rabbits, almost ten times the effective dose. The cause of death was not determined but is probably the result of kidney damage. Fig. 2 shows that the simultaneous administration of 5 mg of vitamin K has no effect on the action of AP. Blood transfusion can raise the prothrombin level for 3–5 hours in the animal receiving the drug.



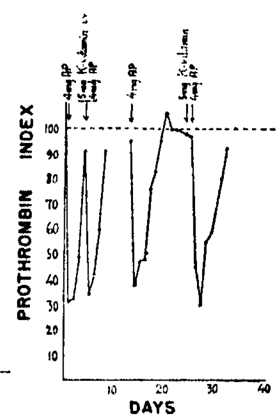


FIG. 1. The restoration of the normal prothrombin index in the rabbit after administration of AP for one month. FIG. 2. The inability of 5.0 mg of vitamin K to antagonize the effect of AP on the prothrombin index of the rabbit.

When 0.25–1.0 gm of AP is given by mouth to normal human subjects a similar fall of the prothrombin index occurs. Seventeen cases of thrombosis of the extremities were treated. When the initial fall in prothrombin index occurred there was a concomitant improvement as indicated by the fall in temperature, and diminished turgor of the leg. Cases of thrombosis cruris (*phlegmasia alba dolens*) were more resistant to the drug and required larger doses. In all cases the course of the disease was shortened and no further thrombosis occurred after the fall in the prothrombin index. Administration of AP is contraindicated in kidney, heart and liver diseases. In actual or suspected vitamin C deficiency, ascorbic acid should be given along with the drug to prevent hemorrhages. The use of AP in the prevention of post-operative thrombosis is under investigation.

In man mild toxic symptoms, such as vomiting and diarrhea, were observed in a few cases after the first administration of the drug, but seldom after subsequent ones. Liver and kidney function tests after treatment with the drug were normal. In two cases minor hemorrhages occurred. These were controlled by the administration of 100–200 mg of 2-methyl-1,4-naphthaquinone disulfate which increased the pro-

[1] A. J. Quick, *Am. Jour. Physiol.*, 118: 260, 1937.
[2] F. S. Schoefield, *Canadian Vet. Rec.*, 3: 74, 1922; *Jour. Am. Vet. Med. Asn.*, 64: 553, 1924.
[3] H. A. Campbell, W. K. Smith, W. L. Roberts and K. P. Link, *Jour. Biol. Chem.*, 136: 47, 1940; 1938: 1, 1941.
[4] M. A. Stahmann, C. F. Huebner and K. P. Link, *Jour. Biol. Chem.*, 138: 513, 1941.
[5] R. S. Overman, M. A. Stahmann, W. R. Sullivan, C. F. Huebner, H. A. Campbell and K. P. Link, *Jour. Biol. Chem.*, 142: 941, 1942.

thrombin index within 3–12 hours. In 4 cases menstruation occurred while AP was being administered and the prothrombin index was 20, but no excessive bleeding was noted. Two pregnant women in the 5th and 9th months, respectively, were successfully treated for thrombophlebitis. Lactating women excrete AP in their milk, as indicated by the lowering of the prothrombin level in the children. The drug can be administered with sulfathiazole, barbiturates and morphine and can be given to patients with tuberculosis and pneumonia.

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THE MINERAL PATTERN OF STEMS FROM VEGETATIVE AND FLOWERING PLANTS AS DETERMINED BY MICRO-INCINERATION[1]

THE ashing of thin sections of plant material was described more than a hundred years ago.[2] Since then investigations of this type have been conducted with both plant and animal tissues. However, considerable difficulty has been encountered when dealing with plant sections, since there is a marked tendency for the thick cell walls to shrink and become displaced during incineration.

Previous investigations have shown that the anatomical structure of a flowering stem is different from that of a vegetative stem.[3,4] Sections of the fourth internode of stems of vegetative and flowering plants were incinerated to observe the mineral pattern in these two types of stems. When observing minerals on a microscopical scale it is necessary to retain as much of the mineral substance after incineration as was present in the living plant. Therefore attention was given to the selection of a fixative which would not dissolve the mineral substance and which would not add mineral substances to the ash. Little or no difference in the amount or distribution of the ash could be detected in the samples fixed in four liquids: absolute alcohol, nine parts of absolute alcohol and one part of formalin, cellosolve and dioxan. Dioxan, however, seemed to have a shrinking effect upon the stem material. The alcohol-formalin mixture was used for further sampling. The material for sectioning was dehydrated in absolute alcohol and cleared in cedarwood oil. After embedding in paraffin, transverse and longitudinal sections 15 μ in thickness were cut on a rotary microtome.

[1] Published with the permission of the director of the Agricultural Experiment Station.

[2] F. V. Raspial, Paris. Baillière, 1833.

[3] O. Christine Wilton and R. H. Roberts, *Bot. Gaz.*, 98: 45–64, 1936.

[4] B. Esther Struckmeyer, *Bot. Gaz.*, 103: 182–191, 1941.

Several substances were tested for their adhesive qualities in an attempt to prevent shrinkage and displacement of the heavy walled cells of the secondary tissue during the incineration process. These adhesives were applied after the paraffin was removed from the sections with xylol. Of the several tried, "Nevillite 123,"[5] which is practically ash free, proved to be the most satisfactory when dissolved one part to two to four parts of xylol depending upon the hardness of the tissue. Photographing of the sections before and after ashing disclosed no change in the position of the crystalline inclusions and wall-impregnating substances during incineration. With this adhesive a more accurate mineral pattern of the thick-walled plant tissue may now be secured.

The amount and pattern of the ash in the vegetative and flowering stems was found to be different. In the plants examined, such as *Cosmos,* poinsettia, *Xanthium* and Wealthy apple, the greater ash residue was present in the flowering stem, particularly in the thick-walled tissues of the vascular cylinder and the outer layers of the cortex.

Samples were also taken of the internodes beginning at the second from the stem-tip through the twelfth inclusive to observe the mineral pattern at different levels of the stem. The greatest difference in the amount of ash in vegetative and flowering stems was in the internodes closer to the stem-tip. Beyond the seventh internode the quantity of ash, although still less in the vegetative stem, was not as different from that of the flowering stem as it was in the higher internodes.

Plants of *Salvia, Cosmos* and *Xanthium* were placed in short days, an environment in which flower primordia are initiated. There was more ash in the stems of plants in the short-day treatment than in those remaining vegetative in long days after 8, 7 and 6 days, respectively.

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[5] Secured from the Neville Company, Neville Island, Pittsburgh, Pa.

BOOKS RECEIVED

ALEXANDER, FRANZ. *Our Age of Unreason.* Pp. 371. J. B. Lippincott Company. $3.00.

GRAY, DWIGHT E. *Man and His Physical World.* Illustrated. Pp. xii + 665. D. Van Nostrand Company, Inc. $3.75.

NEBLETTE, C. B. *Photography: Principles and Practice.* Fourth edition. Illustrated. Pp. xii + 865. D. Van Nostrand Company, Inc. $7.50.

Proceedings of the Eighth American Scientific Congress. Vol. IV: Geological Sciences. Department of State, Washington, D. C.

WAYMAN, DOROTHY G. *Edward Sylvester Morse.* Illustrated. Pp. xvi + 457. Harvard University Press. $4.50.

APPLIED NUCLEAR PHYSICS

By ERNEST POLLARD, *Assistant Professor of Physics, Yale University,* and WILLIAM L. DAVIDSON, JR., *Research Physicist, The B. F. Goodrich Company.*

This book offers a descriptive and explanatory account, for class use, of the facts and methods of artificial radioactivity and transmutation, including properties of nuclear radiation, means of detection of nuclear particles, technique of artificial acceleration, energy relationships in reactions, the manufacture and counting of radioactive elements, isotopes, nuclear fission, and kindred subjects.

Ready in October **Approx. 244 pages;** **6 by 9;** **Probable price, $2.75**

ECONOMIC MINERAL DEPOSITS

By ALAN M. BATEMAN, *Department of Geological Sciences, Laboratory of Economic Geology, Yale University.*

This book constitutes a complete treatise on the subject of economic mineral deposits. The material is presented in three parts: Principles and Processes; Metallic Mineral Deposits; and Non-Metallic Minerals. It is designed for use in either one- or two-term courses in economic geology—both ore deposits and nonmetallics.

Ready in October **Approx. 835 pages;** **6 by 9;** **Probable price, $5.00**

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This new book offers a discussion of the fundamentals of animal breeding, presented in such fashion as to be understandable to those who have no previous knowledge of genetics or the physiology of reproduction. Its aim is to show how to handle stock at the various stages in the breeding program, how to manage the environment, and how to apply principles and tested experience.

Published in September **250 pages;** **5⅜ by 8;** **$2.00**

CHEMICAL ENGINEERS' MANUAL

By D. B. KEYES, *Professor of Chemical Engineering,* and A. GARRELL DEEM, *Assistant Professor of Chemical Engineering; both at the University of Illinois.*

A handbook for chemical engineering undergraduates and young graduates. It contains all the chemical engineering formulae in common use in problems on heat transfer, fluid flow, diffusional operations, distillation, evaporation, absorption, filtration and similar subjects. In addition, there are tables such as equivalents of weight, length, etc., four-place logarithms, and other miscellaneous data useful to the student and practicing chemist.

Ready in November **Approx. 264 pages;** **4¼ by 6¾;** **Flexible;** **Prob. price, $2.50**

SCIENCE NEWS

Science Service, Washington, D. C.

STRANGE RESULT OF AN ATTEMPT TO PRODUCE NICKEL POWDER ELECTRICALLY

IN attempting to produce nickel powder by rapidly electroplating the metal on a copper sheet, Dr. Oliver P. Watts, professor of electrochemistry at the University of Wisconsin, ran upon a strange phenomenon which he reported to the Detroit meeting of the Electrochemical Society.

A coating of nickel appeared on the back of the copper but none on the front. This, he said, was contrary to all recorded experience with plating solutions. Furthermore, no nickel powder was produced.

Dr. Watts had tried to utilize that "bugbear" of the plater, the "burned" deposit, by passing a very large current of electricity through a dilute solution of nickel sulphate. This should have done the trick, because too heavy a current produces a crumbly deposit which frequently drops off. To increase the conductivity of the solution and thereby increase the current, Dr. Watts had added a large amount of sodium sulphate to the solution and also heated it. Such "conducting salts" are frequently used. To his surprise he got only a film of alkali on the front of the plate, but a good adhering coat of nickel on the back. Measurements showed that three quarters of the current had been employed in depositing the alkali and only a quarter in depositing the nickel. The latter part of the current had to pass around the edges of the plate to reach the back. Usually in electroplating the front of an object is more heavily plated than the back. Other metals and other solutions were tried and it was found that the same thing could be done with cobalt and iron, but not as yet with tin, zinc or copper.

As a possible commercial use of this curious phenomenon, Dr. Watts suggests that the solution might be so regulated as to plate front and back equally, but so far he has been unable to get any happy medium between a thicker coat on the front and none at all there.

REAPPEARANCE OF SCHWASSMANN-WACHMANN COMET

A NEW comet announced by L. Oterma at the Observatory of the University of Turku, Finland, reported to Harvard Observatory through Lundmark, Sweden, is none other than the famous Schwassmann-Wachmann Comet No. 1 which has been under constant observation by American astronomers for the past 15 years.

This is not the first time that this comet has been mistaken for a new one. On August 29, 1941, Dr. G. Neujmin, of the Simeis Observatory in the Crimea, observed it and announced a new comet. But only a few weeks before Professor G. Van Biesbroeck had observed it at the Yerkes Observatory. This time again it was observed only shortly before being mistaken for new, namely, on September 6 at the McDonald Observatory. Dr. Van Biesbroeck has recently calculated its positions for the last four months of this year.

This comet is one of the most remarkable known. Its orbit is nearly circular, lying wholly between the orbits of Jupiter and Saturn about 500,000,000 miles from the sun—five times the distance of the earth from the sun. From time to time, the comet, for some unknown reason, increases in brightness, although never becoming visible to the unaided eye. It was during one of these flare-ups that it was discovered in 1927 by the two German astronomers whose name it bears, and it was at a flare-up on each occasion that it was mistaken for a new one.

Because of its nearly circular orbit, the comet is seldom beyond reach of our powerful telescopes and our photographic plates. It descends at times to the 18th magnitude, at other times brightens, as at present, to the 12th magnitude, 250 times as bright. It shows at present a sharp nucleus surrounded by a nebulous envelope. At other times it appears like a faint star.

AUTUMN COLORS

THE bright leaf colors that everybody admires in the autumn are actually there all summer. They are not usually visible until shorter, cooler days come because they are masked by the stronger green of the more abundant chlorophyll pigment, which crowds them into the background. One of the autumnal changes in the plant is the chemical breakdown of the chlorophyll, which becomes colorless, thus permitting the reds and oranges to shine forth.

Leaf colors are of two distinct classes. The purples and purple-reds are due to a soluble type of pigment that is present in the plant sap. It is the same stuff that makes beets red and some kinds of cabbage purple. The yellows and bright reds are due to pigments of the carotin type, which exist in solid little lumps embedded in the living protoplasm of the cells. They are not as easily soluble as the purple pigment in the sap, and won't come out if you soak the leaves in hot water.

Combinations of the purples, purple-reds, oranges and true reds make all the varied, mottled colors we find in autumn leaves—and in the skins of autumn fruits as well. Leaves of a clear yellow, such as you sometimes find on hard maples, have no purple pigment in the sap. Leaves like those of sumac and sweetgum, of a strong, deep wine-red, are colored by a combination of purple sap-pigment and red carotin in the cells. The changes that may be rung on this color-chime are literally endless.

Even more remarkable than the wonder of leaf coloring, though much less conspicuous, is the provision made by the leaves for their falling off. They do not just snap off and drop, as a dead twig might. That would leave the tree covered with thousands of tiny, open wounds through which bacteria and fungus spores might enter, to cause disease and decay. At the point where the leaf-stem is later to detach itself from the twig, a double layer of specialized, corky cells forms, finally cutting off the sap flow to and from the leaf. When it is complete, the union between the two layers becomes dried out and

weak, and finally a little puff of wind finishes the job, letting the dead leaf drift down to earth.

Botanists have given this double layer a special name, "absciss layer." But that is only Latin for cut-off layer, and that is exactly what its function is. The tree or shrub is thus able to bandage its wounds before they actually exist. That is a trick that surgeons and first-aiders would give a good deal to be able to do for humans. —FRANK THONE.

IMMUNE SERUM IN THE TREATMENT OF INFLUENZA

IF an influenza epidemic strikes this winter, the use of immune serum from the blood of the first patients attacked "should be considered" for treatment and prevention and for further studies of influenza prevention, according to a report made by Dr. Joseph Stokes, Jr., of the School of Medicine of the University of Pennsylvania, at the meeting of the Medical Society of the District of Columbia.

Dr. Stokes's cautiously worded advice to his fellow physicians was based on extensive experiments with mice in which relatively small amounts of immune serum protected mice against influenza virus when the protective serum was inhaled by mice. Somewhat larger amounts of the immune serum were required when the serum was injected. In treatment of the mice, the immune serum had to be given within six hours after infection with influenza virus.

Immune serum, from the blood of persons who have just had influenza, contains substances called antibodies which are defensive forces of the body for fighting off the virus. Instead of borrowing these defensive forces from some one who has already had the disease, it is possible to build them up in a person's own blood by vaccination with influenza virus. Dr. Stokes recently reported that such a vaccine protected 43 out of 44 boys who were directly exposed to influenza virus in an experimental study.

The third method of protection against influenza epidemics described by Dr. Stokes consists in sterilizing the air of hospital wards, school rooms, barracks or similar places where large numbers of people congregate. This sterilization may be done by ultraviolet rays or by spraying propylene glycol vapor into the room. The latter seemed to be somewhat more effective than the ultraviolet rays.

Neither of these air sterilization methods, however, can be entirely relied on to stop an influenza pandemic such as swept the world in 1918. The reason, Dr. Stokes explained, is that in pandemics, the travel of the virus through the air may not be the chief manner in which the disease is spread. In pandemics, the disease breaks out suddenly in many widely separated places at the same time. Virus spread through the air is more a factor in epidemics such as those of recent years which traveled across this country in a few weeks.—JANE STAFFORD.

ITEMS

A NEW electronic instrument is being used in flight tests of airplanes which records temperature and pressure changes at the rate of 144 readings every three or four minutes. Developed by the Brown Instrument Company, Philadelphia, this flight recorder replaces three or more men who needed half a minute to write down each reading manually. It was first used on the world's largest plane, the Douglas B19; the recorder automatically printed on paper, during the test flight, the temperatures of all 72 cylinders of the four motors, changing temperatures of the carburetor, exhaust, and of the oil in the fuel lines, and the pressures on wing struts, bulkheads and tail surfaces. In the case of single-seater pursuit ships, the recorder made records that otherwise could not be obtained because test engineers in addition to the pilot could not be carried aloft.

THICK and extra hard coatings of nickel can be formed by adding ammonium salts to the plating bath, and properly proportioning the other ingredients, Dr. W. A. Wesley, assistant director, and E. J. Roehl, research chemist, of the Research Laboratory of the International Nickel Company of Bayonne, N. J., reported to the Detroit meeting of the Electrochemical Society. Many new problems arising in defense activities, the investigators said, involve surfacing of parts to resist wear and corrosion, and the salvaging of worn and mismachined parts, by the electrodeposition of heavy metal layers. The coatings must be hard, have strength, ductility, machinability, adhere strongly, and have a heat expansion close to that of steel. Furthermore, the deposits must not be in layers such as the old "hard baths" gave, but must be homogeneous.

ASTRINGENTS, chemical substances such as are used in so-called "skin tighteners," may enhance the effect of germicides and disinfectants, it was reported before the Denver meeting of the American Pharmaceutical Association. Much used but long in ill repute as antiseptics, the astringents now take their place as an adjunct to other antiseptics. The double action of the two is often desired by physicians but the boost given to germ-killing power of antiseptics by the astringents had not been fully realized. Research evidence presented by Joseph B. Sprowls and Charles F. Poe, of Boulder, Colo., indicates that such chemicals as tannic acid, widely used for burns, has a beneficial effect on the action of several common antiseptics. Development of a single-dose emergency hypodermic unit at the request of the War Department was also reported to the pharmacists by J. D. Hulsmann and F. W. Nitardy, of Brooklyn.

How much water there is in a jelly-fish is the subject of discussion in England even during war time. Dr. A. G. Lowndes, at the Plymouth Biological Laboratory, has determined that jelly-fish in the ocean near Plymouth are composed of about 96 per cent. water, 3 per cent. salts and a trace of fat. The amount of protein, 0.67 per cent., indicates that the animal has only about 4 per cent. protoplasm, the stuff of life. Text-books have long told that jelly-fish contain 99.8 per cent. water, but while they are very liquid, their water content is not as high as that. Most marine animals contain about 80 per cent. water and 15 per cent. protein.

SCIENCE

VOL. 96 — FRIDAY, OCTOBER 16, 1942 — No. 2494

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 — Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE CHEMIST IN THREE WARS[1]

By OTTO EISENSCHIML

PRESIDENT, SCIENTIFIC OIL COMPOUNDING COMPANY, CHICAGO

THE CIVIL WAR

AT the beginning of the Civil War chemistry was in its infancy. The chemical requirements of armies at that time were, of course, proportional to the world's contemporary scientific standards; they comprised in the main the procurement of a few basic materials such as iron, copper and saltpeter; among manufactured products, gunpowder was the most important. Small as these demands appear when compared to those of modern fighting forces, they constituted problems of magnitude for the chemists and industrialists of the time.

The agricultural South, having built its economic structure on cotton, found itself in a precarious position at the outset of the conflict. According to census figures for the year ending June 1, 1860, the United States had produced in twelve months 884,474 tons of pig iron; out of this total the South, represented only by Tennessee and Virginia, had contributed a mere 25,513 tons. The blast furnaces in the South were small and antiquated; a daily output of thirteen tons, reached by newly erected furnaces in Alabama, was considered a decided improvement over the older plants of Virginia and Tennessee. The methods used were obsolete, chemical control unknown. In many cases iron ore and fuel had to be brought from distant places by a dilapidated railroad system or by teams; nevertheless, the Confederacy is said to have produced 50,000 tons annually during the war—a remarkable achievement, especially in view of the

[1] A paper read before the American Institute of Chemists at Chicago, September 18, 1942.

fact that, as the Northern armies advanced, many furnaces had to be abandoned. To augment the supply, collection of scrap iron was instituted early in the war, much along the lines we follow to-day, with Richmond appealing to her patriotic citizens to give up their "broken or worn-out ploughs, plough-points, hoes, spades, axes, broken stoves and kitchen utensils" against adequate compensation.[2] Similarly, lead was collected successfully from various sources. 200,000 pounds were gathered from window-weights in Charleston alone, and a like amount was obtained from lead pipes in Mobile. Large amounts of lead were also systematically recovered from battlefields, and the government paid high prices for the metal so collected.

The only copper mines available for exploitation were located in Tennessee, and these passed into Union hands soon after the beginning of hostilities. Copper was sorely needed for bronze field-guns and for percussion caps. In this exigency, the South bought up turpentine and apple-brandy stills, which were made of copper and of which there was an abundant supply. By stopping the casting of bronze guns and limiting the use of copper to the manufacture of caps, a shortage of this metal was avoided.

In regard to saltpeter the South was relatively better off than her adversary. There were deposits in limestone caverns near Columbia, Charleston, Savannah, Augusta, Mobile and Selma. These were mined under supervision of a special government agency called the Nitric and Mining Bureau. Less than one half of the saltpeter needed was procured in this way; the rest came from other domestic sources and through the blockade.

The direction of all chemical activities in the South was in the hands of three men, to whose energy and ingenuity history has accorded but scant recognition. To earn the world's applause, heroes must—as we chemists know only too well—do something more spectacular than provide their country with sorely needed products, even if it is military ordnance for hard-pressed armies at the front. These three men, on whom nearly as much depended as did on Robert Lee and Joseph Johnston, were Josiah Gorgas, Gabriel J. Rains and John Wm. Mallet. General Gorgas was a Pennsylvanian by birth and had graduated from the U. S. Military Academy in 1841. As an officer in the ordnance office of the United States Army he had shown such outstanding ability that Jefferson Davis appointed him chief of ordnance of the Confederacy as early as February, 1861.[3] He was an organizer of the highest type, possessed of courage, initiative and a driving force that overcame the most discouraging obstacles. General Rains was equally dynamic, resourceful and persevering. Born in North Carolina and graduated from the U. S. Military Academy class of 1842, he was a resident of New York in 1861, but joined the Southern forces as colonel of infantry in March of that year. In September he was made brigadier general and fought with distinction at Shiloh, Perryville and Seven Pines, where he was wounded. But his ability as a chemist was soon recognized, and he was asked to turn his energy from leading troops on battlefields to the less colorful but equally essential task of creating a chemical industry.[4]

The third man of this small group was John William Mallet, an Irishman educated at Trinity College, Dublin, and at Göttingen, Germany. He had taught chemistry at Amherst and at the University of Alabama in the decade preceding the war and was made superintendent of the ordnance laboratories at Macon, Ga., in 1862. One of his principal assignments was the procurement of mercury for the Southern arms, which proved difficult without any native sources of quicksilver. Mallet remedied this shortage, at least partially, by ordering the breaking up of all thermometers and barometers throughout the South. After the war, Mallet became professor of chemistry at the University of Virginia, and in 1882 was elected president of the American Chemical Society.[5]

In 1861, this trio of chemical engineers faced a desperate situation. Only two of the country's powder mills were located in the South, one in South Carolina, built for the sole purpose of furnishing powder for blasting a tunnel, and one at Nashville, which was exposed to enemy attack. The South Carolina plant employed a crew of three men, the one at Nashville a crew of ten. Both together could produce scarcely enough powder for anything more than frontier skirmishes.[6]

Gorgas immediately took steps to put the manufacture of powder on a solid and broad basis. With Rains in actual charge, a large mill was started at Augusta, Georgia, in September, 1861; operations began seven months later. The Augusta plant remained the chief reliance of the Confederacy until the end of the war and furnished all the powder needed, and of the finest quality. Rains even found time to improve the chemical processes. He introduced, for example, the method of steaming the mixed

[2] Rhodes, "History of the United States," Vol. V, pp. 390–394, The Macmillan Company, N. Y., 1919. Miller, "Photographic History of the Civil War," Vol. V, p. 161, The Review of Reviews Company, N. Y., 1912.

[3] Jefferson Davis, "Rise and Fall of the Confederate Government," V. 1, p. 477.

[4] "Photographic History of the Civil War," V. 5. Jefferson Davis, "Rise and Fall," pp. 316–317 and 475.

[5] "History of the Explosives Industry in America," by VanGelder and Schlatter, New York, Columbia University Press, 1927, pp. 107–118.

[6] "Du Pont. One Hundred and Forty Years," pp. 90–99, by Wm. S. Dutton, Chas. Scribner's Sons, 1942.

ingredients for gunpowder just before incorporation in the cylinder mills, which greatly increased the output, besides bettering the quality. When peace came, the Augusta plant was considered one of the most efficient in the world.

As the war progressed, Southern soldiers walked without shoes, lived on parched corn, went in ragged uniforms; but they always had enough ammunition, thanks to the unflagging efforts of Gorgas, Rains and Mallet, who never failed them.

The North, although more highly industrialized at the beginning of the Civil War, also had difficulties in procuring certain products, particularly saltpeter, all of which had to be imported from India. The ordnance department had let its supplies run low and in the fall of 1861, even before much large-scale fighting had taken place, a serious shortage of this critical material developed. Lammot du Pont, the youngest member of the du Pont family who owned the large powder plant in Wilmington, Delaware, was the outstanding chemical genius north of the Mason and Dixon Line. Lammot, then only thirty years old, had graduated from the University of Pennsylvania as a chemist at the age of eighteen. Six foot two, lanky, big-boned and gifted with an iron determination, he soon became a leader in the powder industry. After the end of the Crimean War, he went to Europe to study the latest advances in the art. Before going on this trip, however, he had perfected and patented a process by which Peruvian sodium nitrate could be used for blasting powder in place of saltpeter. This invention, and the work leading up to it, was destined to become a matter of national importance in the not distant future.[7]

When young du Pont became aware of the acute shortage of saltpeter and speculated on its portentous consequences, he asked for and was granted a conference with the Washington authorities; immediately afterward he sailed hurriedly for England to buy large quantities of saltpeter. He arrived there in November, and in a few days had acquired some 2,000 tons. Just when the four ships on which the material was loaded were ready to sail, reports of the *Trent* affair reached London. The British mail boat *Trent* had been stopped on the open sea by a U. S. warship, and, contrary to international law, two prominent Southern passengers, John Slidell and James Mason, had been forcibly removed as prisoners of war.

The British government, greatly incensed at this high-handed—and unauthorized—procedure, lodged a violent protest in Washington, asking for surrender of the two Confederates and an apology for their seizure. To show that her government was in earnest, the Queen declared an embargo on all munitions, and du Pont's boats with their precious loads were prevented from sailing. Excitement ran high, both in Great Britain and the United States. The British ambassador, on December 23, handed President Lincoln an ultimatum, to be answered within seven days. War between the two great English-speaking nations appeared imminent.

In the meantime, Lammot du Pont had returned to America and was in Washington on December 26th. What transpired there is not a matter of record, but can easily be surmised. If the Federal government could not get saltpeter from England or her possessions, the war was at an end. Wars could not be fought without powder, and powder could not be made without saltpeter. On December 30, 1861, Lincoln ordered the unconditional release of the two Southern emissaries. It was an unpopular decision but, although the public remained ignorant of his motives, the President had hardly any choice in the matter.

This little-known backstage setting to one of the Civil War's most stirring episodes had far-reaching consequences. Lammot du Pont was determined not to let the country be caught again in a similar critical situation. From Indian saltpeter he turned to the sodium nitrate deposits of South America, and succeeded even during the war in broadening the scope of his patented process so as to make it applicable also to the manufacture of gunpowder. The Indian monopoly was broken. From then on the United States ceased to depend for its supply of saltpeter on a European nation or her colonies.[8]

Thus the Civil War laid the foundation for the industrial development of the South and, still more important, for the military self-sufficiency of the United States. If wise leadership were to follow, the lessons of the fratricidal slaughter, learned at such bitter cost to both sides, would not be forgotten. The recent past was even then foreshadowing the events of the future. A big war, it was clearly shown, was no longer a mere clash of armed forces; it was a struggle between peoples and entire economic systems, essentially not much different from the competitive struggle between two large business enterprises. The South had starved in the midst of plenty because of its broken-down transportation and finances; the North had almost lost through poor management of its supply department. There was ground for hope that the re-United States would not allow a repetition of similar blunders, and that no attack would ever again find the war department without a thoroughly prepared, all-embracing business organization and an abundance of the most vital sinews of war.

7 "E. I. du Pont de Nemours, A History," Houghton Mifflin Company, 1920, pp. 82–99.

8 "Du Pont, One Hundred and Forty Years." "E. I. du Pont de Nemours, A History."

THE FIRST WORLD WAR

The first World War was characterized by one chemical achievement of such overwhelming interest that it outweighed all others. I am speaking of gas warfare. Aside from its novelty in modern combat, the introduction of this weapon carried with it the germ of a thought which, if it had been properly understood and interpreted, might have changed our entire conception of and preparation for warfare in general. Unfortunately for us, the Germans did develop the thought, and thereby gained an incalculable advantage over her opponents in the present world conflict.

I am not going to discuss at length the pros and cons of whatever moral issues may be involved in the use of poison gases. My personal opinion that gas warfare is no more evil than any other kind of human slaughter is, I believe, shared by most chemists. Attempts to outlaw it are bound to end in failure. Technical progress, whether for good or evil, can not be undone. Even if outlawed, the fear that the enemy will do the unlawful, would force us to keep all our knowledge and preparations up to date. The world has looked in turn upon arrows, Greek fire and gunpowder as illegitimate methods of combat and has tried to suppress them. Only twenty-five years ago, many voices were clamoring for the abolishment of submarines. No one advocates their abolishment to-day. Nations in mortal danger have always ignored peacetime treaties, for war itself is a denial of all laws and agreements. *Silent leges inter arma,* as the Romans put it, "when the arms speak, the law becomes silent." Two men on a rock-bound island fighting for the last crumb of bread or drop of water do not follow Marquis of Queensberry rules. But this is beside the point. The thought I have in mind tends in a different direction.

When the idea of a gas attack, on which German laboratories had worked for some time past, was first submitted to the German High Command, it was received with disdain. The graduates of Potsdam thought they knew all about warfare and wanted no advice from outsiders. It is said that only personal intervention by the Kaiser brought about a change of heart among the commanding generals. Nevertheless, they immediately set out to sabotage the plan, whether through lack of capability or malice is immaterial. The proper procedure would have been to call a conference of their leading chemists, inventors, military officers and business executives—the best brains of the country—to discuss the possibilities of this gas plan and perfect it before putting it to use. The businessmen, if men of vision, would no doubt have voted against its immediate adoption. Let there first be found a gas that was less visible, less odorous and not as easily identified as chlorine. Even a poker player would have advised against tipping a hand that held great possibilities, but still had to be played.

Months would have passed. Then the chemists would have submitted their improved product, phosgene. Invisible, insidious, highly poisonous, it would have broken the Allied front; for no soldiers can stand up against a weapon they can not see and against which there is no defense. Of course, the attack would have to be carried out on a long front, one hundred, two hundred miles at least, and be sustained by a full onslaught against the incapacitated or demoralized opponents. What if victory were achieved by means called unfair or even illegitimate? The world had a way of bowing to the victor, regardless of the means he had employed. One had only to read history for confirmation of this fact.

But the decision was not put into the hands of a board with vision; instead, it was left in the hands of men who had only the narrow view-point of the German military caste. Like the hungry man to whom a good fairy granted one wish and who asked for a meal when he could have asked for a King's ransom, the Germans made their gas attack on a three-mile front; they killed 5,000 Frenchmen and French colonials, injured 10,000 and captured 6,000 more. That was all. There were not even enough German troops in reserve to march through the breach to the English Channel, which they could have done.

This happened on the 22nd day of April, 1915. On the 23rd, 100,000 gas masks, hurriedly made from cotton pads saturated with reducing agents and chlorine-reacting compounds, were on the Allied front. The great peril was past. Germany's chemists had presented their country with a great opportunity to win the war with one stroke, and the general staff had exchanged the gift for a mess of pottage.

From a far-off perspective, this first modern gas attack deserves a much closer study than it seems to have received. Reduced to its simplest terms, this had been the problem. A big business concern, called Germany, had been offered a new invention that would speed up its output, in this case the killing or disabling of enemy troops. As in the case of any other invention, she asked her specialists to pass on its technical merits. The chemists approved. There was a gas called chlorine that could be taken to the front and used to kill people. The supply or manufacturing department affirmed its ability to produce chlorine cheaply and in large quantities. The invention was now submitted to those who had to use it, the plant managers and engineers, or in war, the general staff and the front line officers. They agreed, reluctantly and with understandable professional pride—or perhaps jealousy—that the proposed new method was

feasible; their main objection probably was that existing methods were satisfactory, and that the situation was well in hand. Now the invention should have been passed back to the board of directors, the big keen brains of the enterprise. Here was an invention that could not be patented nor kept secret for any length of time. What was the best policy to profit by it? Disregarding the character of the novelty, the directors would ask several pertinent questions. Could the invention be easily imitated? It could. Why not wait then until it was made more complex before putting it on the market? And when it was time to sell the article, let it be turned out in such big quantities, that competitors would be swept off their feet, and be out of the running before they could catch their breath. But the business firm called Germany had no board of directors; and having no board of directors, she missed her one golden opportunity to win the war.

In principle, there was no great difference between a novelty to be sold to the public and a new weapon called poison gas. Germany lost the first World War because she did not recognize that war had become Big Business; hence she had no board of directors to conduct the war in a business-like fashion. An invention which would have swung the balance was there, but its use was left to the discretion of one single department which muffed it. It was as if a big steel company would leave a question of fundamental policy in the hands of its distributing agents. They would be consulted, of course, but they would not be asked to carry the responsibility; for the introduction of new processes involves more than mere technical sales ability; it involves questions of finance, tariffs, patent laws and others that can only be weighed efficiently by shrewd and experienced groups of masterminds, not by specialists in any one line, no matter how brilliant. The proper utilization of poison gas was neither a purely chemical nor a purely military problem. In its larger sense it was a business problem, and its solution should have been left to the shrewdest business minds of the nation.

In its primitive stages war was a clash of brute force against brute force. By and by weapons were devised and improved, and those with novel arms were the most successful. The waxed bow of the Northern tribes, the short sword of the Romans, showed that technical ingenuity had its rewards even in the early stages of warfare. The men of the Macedonian phalanx were forerunners of our shock troops, the elephants forerunners of steel tanks yet to be invented. At the same time, strategy began taking the place of mere brawn. In spite of these developments, however, war was still largely a matter of soldiering. Just as the owner of a primitive iron furnace was his own chemist, engineer, salesman and credit department, so the primitive general embodied in his own person all the knowledge and ability necessary to organize, arm and lead his troops.

The graduates of Potsdam were finely educated soldiers, but they still thought of war in terms of rifles, siege guns, local strategy. They failed to recognize that modern wars had grown beyond the art of soldiering and had become an enormous business enterprise which they were not trained to conduct.

The German High Command did not properly evaluate what chemists could do, because they lacked the vision and experience of keen and successful businessmen. It was not they who failed; the system failed which they served. One simple businessman, unable to tell a machine gun from a revolver, but shrewd in the ways of the competitive world, sitting in conference with the military officers, might have kept them from the elementary error they were about to commit. His advice could have changed the course of history. But to have such an outsider take part in military discussions is something the German High Command would have considered ridiculous.

The first World War demonstrated that chemical ideas, properly utilized, can win wars. This does not mean, of course, that chemists alone can win them without cooperation from others. In order to win a war by means of a startling invention, or at least help win it, a coordination of four different types of mentality is needed, and they must work in harmony, like a well-organized athletic team or the integrated parts of an aggressive business enterprise.

First, we must have the imaginative type which envisions things that have never happened before; not visionaries who dream of perpetual motion, but minds that can visualize a gas adapted to warfare and base their dreams on sound chemical and physical principles.

Second, we need the specialist, the expert in the field to which the proposed invention belongs and who is competent to judge which dreams may be reasonably expected to come true. He need not be imaginative, but neither must he be hidebound, for it is up to him to translate a vision into an actuality, or else decide definitely that to do so is impracticable. This expert must have a large staff of chemists, physicists, engineers, physicians, mechanics and others at his beck and call, so as to carry new ideas to their completion.

The next man to take over is the man in whose hands the invention is to be placed. In commercial life we call him the distributor; in war he is the military officer at headquarters. It is he who must determine how the invention fits into his task at the front and work out the details of its proper application.

Had a gas best be ejected from projectors brought close to the enemy's lines, or should it be put into shells? Is it advisable to disguise the odor of a gas by the admixtures of other gases? These are questions on which his decision should be final. This officer must be a man of intelligence, for it is up to him to either carry out new ideas or else pass them back to the laboratory to strengthen them for actual combat use, but his authority should not be allowed to extend beyond these specialized tasks.

The fourth type of mind is that of the general director who has before him an over-all picture of the entire war and whose word alone can release the invention. His judgment, not that of the military staffs or any other groups, should decide if, when and how a new weapon is to be put to practical use. If he fails, the invention fails, no matter how meritorious it may be *per se*. The German generals should not have shouldered a responsibility that properly belonged to a type of mind they did not possess.

The great achievement of chemistry in the first World War was the lesson we learned—or should have learned—how to utilize new chemical ideas correctly. Gases may or may not play a prominent part in our present conflict, but other chemical inventions may take their place, carrying with them that element of surprise which is so essential to military success. If such an invention should be brought forth, it will undoubtedly be developed and used with full consideration of the lesson the Germans taught us unwittingly by their abortive gas attack at Ypres almost thirty years ago.

Above all, of course, the first World War confirmed what the Civil War had indicated—that war has become an enormous business and that its direction should no longer rest exclusively on the military branch of the government; strategy, arms and man-power have ceased to be the only means by which war is waged. Each nation needs in addition much other new equipment, such as a research department—scientists. But equally important is a board of directors to coordinate all branches and infuse into the whole structure the shrewdness, experience and all-around brain-power without which no Big Business can be successfully conducted.

(To be concluded)

SCIENTIFIC EVENTS

DEATHS AND MEMORIALS

DR. EDMUND S. CONKLIN, formerly head of the department of psychology of Indiana University, died on October 6 at the age of fifty-eight years. Before going to Indiana University, Dr. Conklin was head of the department of psychology at the University of Oregon.

DR. WINFIELD SCOTT HALL, since 1919 emeritus professor of physiology of Northwestern University, died on October 2 at the age of eighty-one years.

DR. FRANK WILLIAM MARLOW, professor emeritus of ophthalmology of the College of Medicine of Syracuse University, died on October 4. He was eighty-four years old.

DR. HERBERT POTTS, professor emeritus of oral surgery of the Dental and Medical School of Northwestern University, died on October 7 at the age of sixty-nine years.

THE death is announced, while a prisoner of Japan, of Dr. Robert Cecil Robertson, professor of bacteriology at the University of Hongkong and a member of the League of Nations Medical Mission. He was fifty-three years old.

Nature announces the death of Dr. L. Aschoff, professor of pathological anatomy at the University of Freiburg in Breisgau, aged seventy-five years, and of Dr. H. C. Lawrence, formerly of the Imperial Forestry Service, Burma, on August 25, at the age of sixty-seven years.

THE Soviet Academy of Sciences has set up a special committee, under the chairmanship of M. Krylov, the mathematician, who translated Sir Isaac Newton's works into Russian, to celebrate the tercentenary of Newton in December.

MICROFILM RECORDS OF THE LINNEAN SOCIETY OF LONDON

SOME time ago a grant was made by the Carnegie Corporation to the Linnean Society for the purpose of making a complete photographic record of all Linnean manuscripts and specimens. Although these documents were in storage outside London the task of photographing the material has now been completed. At the time the grant was made the officials of the Linnean Society offered to deposit a complete microfilm record in some American institution, and later the council of the society selected Harvard University as the place of deposit. The extensive series of microfilms, transmitted from London through British government channels, is now at the Arnold Arboretum. As soon as the necessary descriptive data are received these will be deposited at the Gray Herbarium, Harvard University. Once the material is organized arrangements will be made to supply

individuals and institutions with prints at the cost of reproduction.

E. D. MERRILL

POSTGRADUATE COURSE IN INDUSTRIAL MEDICINE AT THE LONG ISLAND COLLEGE OF MEDICINE

THE industrial health problem, measured by the soaring curve of accidents and absenteeism due to illness, appears to be most critical. It is well known that industrial illnesses and accidents are rising, at a rate which in some states is outrunning the rise in employment. Sound industrial health measures more widely applied should help to arrest this trend, conserve manpower and thus aid the war effort. These figures have been cited to indicate the scope and increasing gravity of the situation.

By the end of 1942 twenty million Americans will be at work in war plants—almost three times as many as were at work in such plants on January 1. Sixty million persons will have employment in all types of gainful occupation by the end of 1943. One third of these sixty million will be women, many of whom are new to industrial work. The rest will be men, most of whom are either too old, too young or who are physically unfit for service.

If the health problem in industry is critical now, consider what it will be when these millions of workers, most of whom are poor health risks and inexperienced in industrial work, are in the factories. In the last analysis industrial health is a medical problem. It is to the plant physician, be he full-time, part-time or "on call," that management must look in solving its health problems. Upon the medical profession rests the responsibility for safeguarding industrial health. Medical schools share in that responsibility, for they are one of the media through which training for medical service in industry is carried on.

The supply of physicians with industrial medical training is limited. Yet many more physicians with a grounding in industrial health are needed to serve in new and expanded war plants and in civilian industry and service. Many physicians now serving industry part-time or "on call" will be needed for full-time service, possibly in more than one plant.

Granting all this, the college had the problem of deciding on the type of course it would offer. It appeared that at least two conditions should be met: (1) the course should be so arranged that physicians within commuting distance could enroll and still carry on their practise; (2) the course should be organized to meet the requirements for grounding in the fundamentals of the subject that would fit the needs both of physicians with some experience in industrial medical practise and physicians with little or none.

In its planning the college had the benefit of the advice of a number of industrial physicians, notably Dr. Cassius H. Watson, medical director of the American Telephone and Telegraph Company, and Dr. John J. Wittmer, medical and personnel director of the Consolidated Edison Company, both of them alumni of the college. The principle they stressed from the start was: Keep it practical.

As it was finally developed, the course, which will be given from November 2 to 13, consists of two weeks of afternoon and evening lectures with morning clinics in the medical departments of industrial concerns. The material for the first week will cover the organization and operation of typical medical departments, physical examinations, study of absenteeism and a review of the human factors in industrial medical work. In the second week lectures and seminars on accidents and their prevention, industrial toxicology, traumatic surgery and nutrition have been scheduled. It was hoped that these topics would provide orientation in the main problems of industrial medicine for the physician new to this special type of practise and a new approach to some of these problems on the part of the physician with some experience in industrial practise.

A series of nine morning clinics, most of them to be held in medical departments of industrial concerns, have been arranged with the object of demonstrating to the students the subjects covered by the lectures of the previous day. A plan of internships of a month's duration in industry immediately following the course was devised for physicians who desire further training and who could be placed. Thirty-nine industrial physicians and experts in related fields such as compensation insurance will lecture in the afternoon and evening sessions. Twenty-three of these are from the metropolitan New York area and sixteen from other parts of the east.

The fee for the course is \$50, \$10 of which is payable in advance. Students may apply for admission for a part of the course, although they must elect to attend at least two full days of afternoon and evening lectures. The "per diem" charge is \$5. The number of full-time students will be limited to fifty.

ALFRED H. CRAWFORD

THE VAUGHAN RESEARCH AWARDS IN HORTICULTURE

AWARDS of \$500 each are to be provided by the American Society for Horticultural Science for the two outstanding papers of the year presented before the society. These awards are made possible through the generosity of L. H. Vaughan, of the Vaughan's Seed Stores of Chicago. They will be known as the Vaughan Research Awards in Horticulture. One award is to be made in the field of flori-

culture and one in vegetable crops. The awards for 1942 will be made at the winter meeting of the society in New York City which will be held from December 29 to 31, and will be selected from the papers which have been presented before the society during 1942.

Preference will be given to papers that present new discoveries in these fields, showing promise of commercial importance or practical application. Preference will also be given to papers by authors under thirty-five years of age. The papers will be judged on the basis of originality, soundness, accuracy, clearness and conciseness of presentation, and on the value of the work, especially in its practical applications.

The American Society for Horticultural Science was organized in 1903 to promote the science of horticulture. Its membership is composed of horticulturists and technical workers in horticulture in the United States, Canada, Mexico and abroad. Each year in connection with the annual meeting of the American Association for the Advancement of Science it holds a three-day program at which timely horticultural topics on fruits, vegetable crops, ornamental horticulture, floriculture, genetics, plant physiology and biochemistry are presented and discussed. In addition, round table discussions are held on such horticultural topics as varieties, educational methods, extension methods, nomenclature, research technic and special crops. Joint meetings are held with related science groups, such as phytopathology, genetics, soil science and botany.

In addition to the annual meeting, sectional meetings are held each year on the Pacific Coast, in the South and in the Great Plains area. The papers and discussions from these meetings are published by the society in two bound volumes of "Proceedings" amounting to approximately 1,200 pages each year. Dr. H. B. Tukey, Geneva, N. Y., is secretary of the society.

THE FIFTIETH ANNIVERSARY OF THE DEPARTMENT OF ZOOLOGY OF COLUMBIA UNIVERSITY

PROFESSOR LESLIE C. DUNN, executive officer of the department of zoology of Columbia University, announces that the department will celebrate on October 16 and 17 the fiftieth anniversary of its founding.

Dr. Nicholas Murray Butler, president of the university, will be the principal speaker at a dinner to be held in the Men's Faculty Club on Friday evening, October 16. Addresses tracing the progress of the department over half a century will be delivered by distinguished zoologists from other institutions who have received the Ph.D. degree at Columbia. Dr. James H. McGregor, recently retired from active service in the department to become professor emeritus, will preside.

Dr. Butler will speak on the origins of the department; Albert P. Matthews, professor emeritus of biochemistry at the University of Cincinnati, will review its early history with emphasis on the achievements of Professor Edmund B. Wilson in experimental embryology and cytology; Dr. Charles Packard, director of the Marine Biological Laboratory at Woods Hole, Mass., who received his Ph.D. in the department in 1914, will deal with the work of the department during his day; the development of the new science of genetics under Dr. Thomas H. Morgan and Dr. Edmund B. Wilson will be described by Dr. Curt Stern, head of the department of biology at the University of Rochester and formerly fellow of the International Education Board at Columbia; Dr. Alfred S. Romer, professor of zoology at Harvard University, will stress the connections of the department with the American Museum of Natural History, where Professor Henry Fairfield Osborn, paleontologist and first chairman of the department, was head of the division of mammalian paleontology, and Professor William K. Gregory now serves as curator of comparative anatomy and ichthyology. Dr. Meryl Rose, instructor in biology at Smith College, who received his Ph.D. at Columbia in 1940, will speak as a representative of his own day in the department.

A statement issued by Professor Dunn reads:

The work of the department from its inception in 1892 has centered in the study of evolution, heredity and the development and organization of the living cell and body.

The first chairman of the department, Professor Osborn, played a leading part in the investigation of the succession of animals of the past through their fossil remains. His associate, Bashford Dean, was a leading student of the fossil fishes and founder and first director of the Biological Station at Cold Spring Harbor.

Professor McGregor devoted himself to the study of the ancestry of men, and his reconstructions of primitive man based on fragmentary skeletal remains are familiar to most biologists. Henry E. Crampton, a member of the department since 1893, investigated the land snails of some of the Pacific Islands to confirm Darwin's contention that specific differences originate by the accumulation of individual differences.

Under the leadership of Thomas H. Morgan and Edmund B. Wilson, with the cooperation of Alfred H. Sturtevant, Hermann J. Muller, Calvin B. Bridges and others, the mechanism of Mendelian heredity was elucidated in detail, and the chromosome theory of heredity, or, as Morgan later called it, the theory of the gene, was developed at Columbia between 1910 and 1928.

Protozoology, the study of one-celled animals, had its American beginnings and underwent its chief development in this department, under the leadership of Gary N. Calkins.

The association of cytology and genetics continued after Wilson had retired, and Morgan had resigned to become director of the new laboratories at California In-

stitute of Technology, with Schrader and Pollister in the field of cytology, and in genetics, Dunn and Dobzhansky in the zoology department and Rhoades in the botany department. These five men continued the work of Morgan and Wilson on heredity in relation to evolution, to development and to the structure and behavior of the finer constituents of cells.

With the appointment of Professor Selig Hecht and the establishment of the Laboratory of Biophysics in 1926, physiology became a subject of advanced instruction and research. The work of that laboratory has been centered on the mechanisms by which organisms respond to light, and the work of Hecht has laid the basis for an understanding of some of the fundamental processes of vision.

The two-day celebration will end with open house and tea in the department on October 17.

SCIENTIFIC NOTES AND NEWS

The autumn meeting of the National Academy of Sciences will be held in the Academy Building, Washington, D. C., on Monday, October 26. The meeting will be a business session for members only, and it is expected that the session will be confined to that one day, beginning at 9:30 A.M.

The autumn general meeting of the American Philosophical Society will be held on November 20–21, beginning at 10 A.M. on Friday, November 20. The society will provide hotel entertainment for non-resident members and invited guests if they will notify the executive officer as soon as possible of their intention to be present at the meeting. For members and invited guests from a distance the society will, as usual, meet the regular hotel charges for rooms during the period of the meeting and for such meals as are not otherwise provided for by the society. On Friday, November 20, there will be a continuation of the program on the "Early History of Science and Learning in America" and on Friday evening a public lecture followed by a reception. On Saturday morning, there will be an executive session of the members followed by papers on various subjects and reports of progress by recipients of grants from the research funds. Dr. L. P. Eisenhart has succeeded as executive officer Dr. Edwin G. Conklin, who is now president of the society.

The title of professor emeritus of psychology was conferred in September on Dr. Walter B. Pillsbury by the University of Michigan. Dr. Pillsbury, who reached the age of seventy years last July, has been a member of the faculty for forty-five years, having been appointed instructor of psychology in 1897.

Chemical and Engineering News states that Milton Kutz, who started work as an office boy forty-five years ago and is now assistant to the general manager of the Electrochemicals Department of E. I. du Pont de Nemours and Co., Inc., was given on August 3 a testimonial dinner by his associates.

Dr. Elise Depew Strang L'Esperance, a founder of the Kate Depew Strang Cancer Prevention Clinic of the New York Infirmary for Women and Children and associate commander of the Women's Field Army of the American Society for the Control of Cancer, was presented at a joint dinner on September 24 of the American Society for the Control of Cancer and the New York City Committee with the Clement Cleveland Medal, awarded annually by the New York City Cancer Committee "for outstanding contributions to cancer control work."

It is reported in *Museum News* that officers of the newly established Minneapolis Science Museum Society have been elected as follows: Alger R. Syme, *president* (geological society); John S. D. Clark, *first vice-president* (bird club); Wensell Frantzich, *second vice-president* (astronomy society); Ward H. Benton, *treasurer* (mineral and gem club); and Miss Macy Spracher (botanical society). Milton D. Thompson is director of the museum. The society was organized on May 20 to combine all the organizations that have been using the Minneapolis Public Library Science Museum as headquarters. It will have control of the funds of the former "Museum Federation." It will endeavor to increase the membership in order to provide support for the museum, which has been struggling for its existence since the withdrawal of a WPA project.

Dr. Herbert E. Longenecker has been appointed associate professor of biochemistry and associate director of the Buhl Foundation projects in the University of Pittsburgh during the absence of Professor Charles Glen King, who is on leave to serve as scientific director of the Nutrition Foundation. Dr. King is also visiting professor of chemistry at Columbia University.

Henry P. Treffers, instructor in biochemistry at the College of Physicians and Surgeons of Columbia University, has been appointed assistant professor of comparative pathology and biochemistry at the Harvard Schools of Medicine and Public Health.

Dr. Laurens H. Seelye, formerly president of St. Lawrence University and recently assistant to Dr. Stephen Duggan, chairman of the Emergency Committee in Aid of Displaced Foreign Scholars, has gone to Istanbul, Turkey, where he will teach philosophy

during 1942–43 at Robert College and the Womans College.

R. V. SOUTHWELL, professor of engineering science at the University of Oxford, member of the British Aeronautical Committee, has been appointed rector of the Imperial College of Science and Technology, University of London, in succession to Sir Henry Tizard, who was recently elected president of Magdalen College, Oxford.

DR. ALBERT W. DAVISON, head of the department of chemical engineering and chemistry at the Rensselaer Polytechnic Institute, has been appointed director of research for Owens-Corning Fibreglass Corp., joint subsidiary of Owens-Illinois Glass Co. and Corning Glass Co., with laboratories in Newark, Ohio. He will take up the work on January 16.

DR. T. ROYDS, formerly director of the Kodaikanal and Madras Observatories, has been appointed professor of astronomy in the University of Istanbul.

DR. CHESTER M. SUTER, professor of organic chemistry at Northwestern University, has been appointed director of chemical research at Winthrop Chemical Company, Inc., at Rensselaer, N. Y.

DR. GRANT W. SMITH, assistant professor of chemistry at the University of Kansas City, where he has taught for the past seven years, has joined the research staff of the B. F. Goodrich Co., Akron, Ohio, as research chemist in the Koroseal Division. He will be engaged in research in polymerization.

DR. ROBERT B. HALL, professor of geography at the University of Michigan, has returned after a year's stay in Latin America, where he made a thorough study of Oriental settlements, with particular emphasis on Japanese colonization. He is now preparing a report on his findings for the Rockefeller Foundation.

DR. CHARLES F. SCOTT, professor of electrical engineering emeritus of Yale University, has been appointed a member of the Sectional Committee on Definitions of Electrical Terms of the American Standards Association.

BY an order of the British Privy Council, Professor David Keilin, Quick professor of biology at the University of Cambridge; Sir Henry Hallett Dale, director of the British National Institute for Medical Research and president of the Royal Society, and Colonel Sir Charles Glen MacAndrew, Member of Parliament, have been appointed members of the Medical Research Council.

A COMMITTEE has been formed under the chairmanship of Sir John Russell, F.R.S., to work with the British Allied Technical Advisory Committee on scientific problems connected with post-war agricultural reconstruction in devastated Europe. Another committee, with Dr. Dudley Stamp as chairman, will consider the further application of science to rural planning, as suggested at the conference on science and world order in 1941.

THE *Journal* of the American Medical Association reports that Dr. Thomas Parran, Surgeon General, U. S. Public Health Service, attended the Inter-American Conference on Agriculture as a counselor and as a guest of honor of the Federal Department of Health. He was received by President Avila Camacho and by the National Academy of Mexico. Dr. Parran visited the Institute of Tropical Diseases, the School of Hygiene and Public Health, the tuberculosis sanatorium in Huipulco, the Institute of Hygiene, the Central Laboratories and the Army Hospital. He inspected the malaria works in the state of Morelos and other services under the control of the Federal Department of Health and the Secretariat of Public Assistance.

CLIFFORD S. GARNER, assistant professor of chemistry at the University of Texas, is on leave of absence to enable him to work on a project under the National Defense Research Committee at the University of California in Berkeley.

THE twelfth Joseph Henry Lecture of the Philosophical Society of Washington was delivered on October 10 by Dr. Francis Bitter, associate professor of the physics of metals at the Massachusetts Institute of Technology. He will take as his subject "The Scientific Significance of Ferromagnetism."

PROFESSOR LAURENCE IRVING, of Swarthmore College, gave on October 12 an illustrated address before the section of biology of the New York Academy of Sciences. He spoke on "The Action of the Heart and Circulation of Seals, Beaver, and Other Diving Animals During Diving."

DR. THOMAS FRANCIS, JR., professor of epidemiology at the University of Michigan School of Public Health, Ann Arbor, will deliver under the auspices of the Xi chapter of Phi Beta Pi the annual Clarence Martin Jackson lecture of the University of Minnesota. He will speak on "Interpretation of Current Studies in the Control of Epidemic Influenza."

THE *Journal* of the American Medical Association reports that Dr. Eugene R. Kellersberger, New York, executive secretary of the American Mission to Lepers and formerly a medical missionary in Belgian Congo, Africa, delivered a lecture at the Mellon Institute on October 9, under the auspices of the University of Pittsburgh School of Medicine. The subject of the

lecture was "Twenty-Four Years' Experience with Tropical Diseases."

THE American Association of Civil Engineers held a joint meeting with the Engineering Institute of Canada at Niagara Falls, Ontario, from October 13 to 15.

THE thirty-first National Safety Congress and Exposition of the National Safety Council will be held in Chicago from October 27 to 29 under the presidency of Colonel John Stillwell.

THE new laboratory of electroencephalography at the School of Medicine of Stanford University was opened on October 8.

APPLICATIONS for research fellowships in medicine, dentistry and pharmacy in the University of Illinois are being considered for the year beginning on September 1, 1943. Appointments to these fellowships will be announced on January 1. Candidates must have completed a training of not less than eight years beyond high-school graduation. The fellowship carries a stipend of $1,200 a calendar year with one month's vacation. Application blanks and further information may be secured from the secretary of the Committee on Graduate Work in Medicine, Dentistry and Pharmacy, 1853 W. Polk Street, Chicago, Ill.

Museum News states that the Museum of Comparative Zoology, Harvard University, will discontinue with Volume 55 the memoir series of the museum, which was begun nearly eighty years ago. Decision to concentrate on scientific research is the reason. It is also reported that the *New England Naturalist*, published quarterly by the New England Museum of Natural History, Boston, since December, 1938, suspended publication with the February issue.

HARVARD COLLEGE will receive a residuary bequest of $259,089 under the will of Henry Osborn Taylor, author and historian, who died on April 13, 1941. The will directs that the bequests be applied toward the maintenance of salaries for members of the teaching staff.

THE University of California College of Pharmacy has been accredited by the American Council on Pharmaceutical Education and given membership in the American Association of Colleges of Pharmacy. In announcing this action, which places the College of Pharmacy on the same footing as other accredited colleges, Dean L. A. Schmidt explains that the delay in receiving this status was due to the reorganization of the curriculum and the modernization of laboratories and equipment which has been in progress for five years.

DISCUSSION

NEW EPIDEMIOLOGICAL ASPECT OF SPOTTED FEVER IN THE GULF COAST OF TEXAS

THE alarming increase of typhus fever in Texas, reaching in 1942 the highest figures in modern Texas history, was recently accentuated by a localized outbreak of spotted fever. Four children living in a wooded area of the Gulf Coast were attacked by this disease, which was fatal in two cases. Confluent hemorrhagic spots involving the skin of victims were the most spectacular symptoms on which the disease was diagnosed by Dr. B. Reading, professor of pediatrics. Gross pathology and histopathology were characteristic of spotted fever. Rickettsiae, coccoid in type, were found in endothelial cells of various organs.

Two strains of the infective agent have been established by the undersigned in guinea pigs inoculated with material from the above cases. After incubation of 2 to 4 days a high fever of from 6 to 9 days' duration developed in the infected animals. Mortality in guinea pigs is very low. Occasionally scrotal reaction has been noted. Intracellular coccoid Rickettsiae were found in sections of guinea pigs' organs.

The surviving guinea pigs were found immune against spotted fever strain from Montana kindly furnished by Dr. R. R. Parker but susceptible to flea- and louse-borne typhus strains.

The locality from which the cases came was found by us and by the entomologist of the Texas State Health Department to be infested heavily with the tick, *Amblyomma americanum.* Two specimens of the same species were also collected from the family of the victims. A thorough survey of the same area repeated two months later by U. S. Public Health Service and the Texas State Health Department again revealed *A. americanum* only among several thousand tick specimens collected. In both surveys no *Dermacentor variabilis* or any other type of tick was present.

These findings are of interest as they offer weighty evidence suggestive of spotted fever transmitted in nature by *A. americanum* as a new additional carrier of the disease. Experimental transmission tests by Parker, Philip and Jellison (1933) have proven *A. americanum* as an efficient carrier of Rocky Mountain spotted fever. The above authors have also discussed the possibility of *A. americanum* being a natural carrier of that disease but no case of spontaneous infec-

tion has been definitely attributed to this tick before the observations reported here. On the other hand, the genus Amblyomma is known to be a vector of spotted fever in Brazil and Colombia. Under these circumstances, the spotted fever of the Gulf Coast would be more closely related epidemiologically to that of South America than to that of the Rocky Mountains.

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ADDITIONAL STEROIDS WITH LUTEOID ACTIVITY

RECENT experiments lead us to believe that contrary to common opinion the progestational type of luteoid activity is detectable in many steroids and is not dependent upon the presence of an α-β unsaturated ketone group at C_3. Bioassays were performed on the immature rabbit according to McPhail[1] with the only modification of using 3 subcutaneous injections of 5 γ of estradiol in 0.1 cc of peanut oil subcutaneously every second day during the period of sensitization.

Since considerable confusion has been created in the literature by the inadequate description of steroids used for pharmacological assays, we shall refer to our compounds by their full systematic names [for terminology see Selye[2]] followed in brackets by their common names—whenever such are in use—and the melting point of our sample. The dosages given represent the total amount administered during the test.

The following steroids proved to possess progestational activity at the dose levels indicated: 17-ethyl-Δ^5-androstene-3(β)-ol-20-one (pregnenolone, M.P. 186°) 10 mg; 17-ethyl-Δ^5-androstene-3(β),21-diol-21 acetate (acetoxy-pregnenolone, M.P. 183–184°) 25 mg; 17-ethyl-Δ^4-androstene-3,11,20-trione-17,20-diol (Kendall's Cpd. "E", M.P. 215–218° (dec.)) 2 mg; 17-butyl-Δ^4-androstene-3,20-dione (21-ethyl progesterone, M.P. 115°) 10 mg; Δ^4-androstene-3,17-dione (M.P. 170°) 25 mg; Δ^5-androstene-3(β),17(α)-diol (androstenediol, M.P. 184–185°) 50 mg.

The following compounds proved to be devoid of progestational activity at the dose level indicated: Δ^5-androstene-3(β)-ol-17-one (dehydro-*iso*-androsterone, M.P. 146°) 50 mg; Δ^4-androstene-3,17-dione-6(α)-ol acetate (M.P. 176°) 4.5 mg; 17-*iso*-heptyl-Δ^5-androstene-3(β)-ol-25-one (27-nor-cholestenolone, M.P. 127–128°) 50 mg; the M.P. 180–182° epimer of Δ^5-17a-methylchrysopregnene-3(β),17a(?)-diol-17-one at 10 mg and its M.P. 275–278° isomerid at 5 mg.

It should be emphasized that the material available did not suffice in each case to perform a sufficient number of assays on a wide range of dosages and that there is considerable individual variation with regard to the sensitivity of rabbits to progestational compounds. Hence the doses at which we detected definite activity should not be regarded as accurate threshold doses suitable for quantitative comparisons, although positive tests are qualitatively conclusive. Pregnenolone and acetoxypregnenolone have been assayed at various dose levels on 20 rabbits so that the threshold dose of 10 mg for the former and 25 mg for the latter may be regarded as fairly accurately established. The fact that they both possess progestational properties indicates that neither the ketone group at C_3 nor the Δ^4-double bond are essential prerequisites for luteoid activity. It will be recalled that both these compounds are also endowed with corticoid activity,[3] but in this respect acetoxypregnenolone is more active. It appears, therefore, that in the Δ^5-3-ol series, as in the Δ^4-3-one series (confront with progesterone and desoxycorticosterone acetate), introduction of a 21-acetoxy group increases the corticoid, but decreases the luteoid potency.

A detailed description of these experiments as well as of the relevant literature will be given at a later date. At this time we merely wish to call attention to the fact that progestational activity is exhibited by many more compounds than has hitherto been suspected.

Acknowledgments: The cost of these investigations was defrayed from a grant given by the Hoffmann-LaRoche Company which, through its Montreal representative, Paul Blanc, also supplied some of the steroids used. The authors are also indebted to Professors E. C. Kendall, L. Ruzicka and Drs. G. W. Holden, E. Schwenk and H. Stavely for additional compounds.

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[1] M. K. McPhail, *Jour. Physiol.*, 83: 145, 1934.
[2] Hans Selye, *Rev. Canad. de Biol.*, 1: 577, 1942.
[3] Hans Selye, SCIENCE, 94: 94, 1941.

THE OCCURRENCE AND SIGNIFICANCE OF MARINE CELLULOSE-DESTROYING FUNGI[1]

IN the course of investigations on the decomposition of wood submerged in sea water the author has recently isolated a series of marine fungi which readily attack wood and other cellulosic plant materials under marine conditions. Extensive data concerning the distribution of these aquatic fungi show that they are of very common occurrence along the North Atlantic coast, with the present known range from Newfoundland to New York Harbor. Further evidence on the

[1] Preliminary note.

occurrence of these organisms will probably indicate a much more wide-spread distribution in oceanic waters.

Pure cultures of ten species of the marine cellulose-destroying fungi have been obtained from wooden test blocks which had been permanently submerged for six to ten months in the sea. Several other species have been isolated from specimens of decaying piling collected by the author in various Massachusetts harbors. The wooden test blocks as well as valuable data have been supplied through the courtesy of the William F. Clapp Laboratories in Duxbury, Mass. The organisms thus far isolated belong to the Pyrenomycete group of the Ascomycetes and to several groups of the Fungi imperfecti. In certain species the spores and the mode of spore dispersal indicate adaptation to aquatic conditions. In many cases the abundant occurrence of black perithecia on the surface of test blocks and other specimens has facilitated the isolation of pure cultures.

Histological and micro-chemical examination of infected material shows that the fungi bring about a rapid enzymatic hydrolysis of the cellulose in the thick secondary walls of plant fibers. The fungal hyphae penetrate with ease the cell walls of both hard and soft woods as well as those of the various fibers used in cordage. The exposed portions of plant materials attacked by the organisms exhibit a marked deterioration involving loss of cellulose and concomitant reduction in tensile strength.

Extensive studies of these fungi are now in progress to determine their rates of growth on various substrata.

Dr. David H. Linder, of Harvard University, is collaborating with the author in this series of investigations. A joint publication is now in preparation concerned with the morphology, taxonomy and physiology of these organisms.

It is deemed desirable to make a preliminary statement at the present time on the existence of these hitherto unreported marine fungi, owing to their extremely common occurrence and considerable economic significance, particularly in the destruction of cordage and other plant materials exposed to marine conditions.

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TOO HOT FOR THE DINOSAUR!

The point to the Dinosaurian bird resemblances is that these recur over a long reach of geologic time and never appear assembled in any one type. An allowable inference is that the Dinosaurs in the course of their long deployment made some approach towards warm-bloodedness; while the respiratory function may have varied markedly within the group as time went on. Certainly as the Cretaceous waned a much changed respiratory balance ensued. The photosynthetic oxygen release of the more and more distinctly dicotyledonous forests heralded the mammals and the birds.

Also, the laying down of heavy beds of coal and eras of limestone formation meant that an age-long abundance of aerial carbon dioxide, the breathing stimulus, was no more. There the Dinosaur failed; and in all his later life there is merely discernible a course of resistance to environmental change. Continental planation in later Cretaceous time was marked; but taking climate and the food supply there must have been left over many an "asylum" in which the Dinosaur could have lived on, bar that fatal lack of carbon dioxide. In its presence the Dinosaur had earlier lived through several periods of relative climatic warmth.

Admissibly, "the earth makes its own climates." Thus the surficial internal heat must have tended to lessen as Mesozoic times ended and the emergence of the Andines and the Rockies began. Global temperature was then merely normally warm for the Dinosaur far into northerly latitudes. Though, then, the plus and minus chemistry of respiration led to the end of that stupendous reptilian brood. In its stead arose the mammals and birds.

As between origin and extinction the atmospheric oxygen-carbondioxide ratio becomes a foremost factor. As assumed, a late Cretaceous withdrawal of much carbondioxide would have had a worldwide cooling effect fully balancing warming due to continental planation. Hence the time is here when the animal and plant physiologist and the geologist are much in need of coordinating their studies. For there stand adposed in the Mesozoic the Dinosaurs and the Cycadeoids. Were not the factors of origin and extinction complementary for both?

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THE DIFFUSION OF SCIENCE[1]

The individual scientist in the vanguard has been able to win to his understanding and eminence only by a lifetime of the most arduous and painstaking thoroughness. He has watched the pernicious social

[1] Excerpt from "The Diffusion of Science" by J. L. Bennett, Chapter III, pp. 51–53. The late Jesse Lee Bennett, of Baltimore, wrote and worked actively in the field of adult education and the diffusion of knowledge. He left a manuscript ten years ago which his mother has just had published by the Johns Hopkins Press, "The Diffusion of Science." This, to me, seems to be a very important book, and from it I have had a short excerpt copied which is so well expressed that I believe that it would be generally helpful to reprint it in the pages of Science.—Joseph L. Wheeler.

consequence frequently resulting from a few careless or hasty words on the part of some fellow scientist. He has come increasingly to understand the need for the most relentless precision of expression. He has come to realize ever more keenly the enormously complicated nature of all the phenomena investigated by science. He finds it increasingly difficult to make clear to untrained men the conclusions to which his patient, lifetime work have brought him. He finds himself perplexed and annoyed by the dangerous implicit fallacies and errors in the writings of "popularizers" seeking to give the general population some understanding of the work of himself and his confrères. For progress in his own speciality, unceasing concentration upon his researches is necessary. Inevitably he loses something of the common touch, he finds himself ever less interested in the reflection of contemporary life given by magazines and newspapers, he finds himself unable to give the attention necessary to understand the reality underlying contemporary political movements and bringing into prominence conspicuous political personalities. Naturally, he is drawn to those men who are equipped to understand his work—his fellow scientists throughout the world. Every day brings him reason to doubt the capacity of the masses of the population to understand the work with which he is concerned. When, occasionally, he seeks to lend assistance to movements apparently seeking social betterment he is generally perplexed or shocked by the obstacles, intrigues, and ignorances he encounters. However strong his sense of social responsibility, he finds it difficult or impossible to make any effective contributions save in his own work. He realizes that he is performing a highly specialized social function. He comes generally to feel that those concerned with the other highly specialized social functions of government, religion, journalism, education, are performing their tasks in the same spirit in which he attempts to perform his own and that any methods by which he might effectively cooperate with them are difficult to perfect and require thought and energy which his own activities do not allow him. As an actual problem confronting every scientist this situation and this conclusion seem inescapable. Yet, the fact remains that the body of thought with which these scientists, as a world-wide group, are concerned is relatively disinterested and comprises the most enduringly precious possession of mankind, while the activities and concerns of those dealing with government, finance, commerce and all the other complicated general social activities of man are inevitably influenced by considerations arising from self-interest. They are, moreover, socially valuable only to the degree in which they are influenced by the broad social vision which can result only from the knowledge gained from these men in the vanguard, insulated from the great mass of the population and isolated from the daily concerns of men by the wall which all the considerations we have stressed have served to erect.

QUOTATIONS

THE FOOD-PRODUCING POWER OF GREAT BRITAIN

THREE years of war have seen a great increase of our food-producing power. In this time, in what is potentially from the standpoint of the scientist a magnificent agricultural country, agriculture has been more substantially improved than in any previous period, even ten times as long.

To four factors are due the progress made: the farmers and their workers, the Women's Land Army, a great increase in mechanical power on the land, and the application of scientific knowledge. And influencing the form of the progress made has been the policy of the Government, with three outstanding aspects: (1) to plough up grassland for the production of crops for man; (2) to adjust livestock numbers; and (3) to ensure better farming and more from every acre.

In all this the application of science has played an important part. For instance, a large part of the success of the ploughing up campaign may be attributed to making good deficiencies in the soil. There were large stretches of soil which, deficient in lime or phosphates, would not produce good crops or grass. Farmers, by practical experience, had discovered the cause and acquired skill in dealing with it; but science has now supplied a complete remedy. It has been widely applied by the various agents of the Ministry of Agriculture, and in consequence many thousands of acres which had a poor reputation formerly have been made to yield handsome crops. Giant machines and gelignite have helped to reclaim for cultivation swampy fen, the tree-covered tops of downs and bleak mountain sides, but the foundation on which this activity rested was knowledge of the soil and application of the necessary fertilizers.

Last year alone scientific staffs supplied by the Ministry of Agriculture were responsible for 115,000 separate analyses of soil. The wire worm—the grub stage of a little beetle—which can do enormous harm to crops, has baffled the best scientists throughout the world for years, and no remedy is yet known. However, scientists can indicate whether a given piece of land contains many or few of these pests and so advise

what should be grown there. There may be 1,500,000 wire worms to an acre, and the only way to count them is to take a sample of land here and there. Where this number exists, it means that there is one to every four square inches of land, or, put in another way, one and a half wire worms are waiting to eat every seed sown were wheat to be sown there.

Many of the problems of the Minister of Food are shared by the Minister of Agriculture, for the farmers, too, have their heavy workers (horses), their expectant and nursing mothers, and their children, not all of one breed. The two main features of the national livestock feeding plan are rationing, which is so complete that it caters for every animal on every farm and the backyard pigs and hens as well, and the growing of more food for livestock on every farm.

Last year farmers were set the target of an increase of 5 per cent. in output from every acre. If that were achieved it would save well over 1,000,000 tons of shipping. There can be little doubt that it has been achieved, according to one well qualified to judge, and the reasons are favorable weather and better farming, which, as well as better effort, meant the application of scientific principles. Prominent here have been the wide-spread introduction of ley farming and the wise use of fertilizers, including a top dressing administered at the right time.

In these war years the link between the farmer and the scientist has been greatly strengthened. In every county there is a county organizer, with a staff, who works with the war agricultural executive committee, and from whom the farmer can obtain advice on every aspect of his work. He is able to refer special difficulties to thirteen advisory centers, where highly specialized workers in the agricultural sciences are able to answer his questions. These centers must be fed from research institutes, of which there are now a great number. But the scientific knowledge available to the farmer is drawn from the whole world. There is maintained in England on behalf of the Empire a series of imperial agricultural bureaus whose work it is to abstract and present in convenient form the scientific knowledge of the entire world.—Food correspondent of *The Times*, London.

SCIENTIFIC BOOKS

ELECTRICITY AND MAGNETISM

Electricity and Magnetism. By Norman E. Gilbert. Revised edition. New York: The Macmillan Company. 1941. $4.50.

In producing a revised edition of this well-known text many changes have been made. The material on power engineering, some of which seemed rather out of place in a physics text, has been abbreviated, but the sections dealing with electron tubes and their uses have been rewritten and brought up to date. Sections have been added on the theory of dielectrics, moving electrons and electron optics and on the recently proposed systems of units. The last chapter contains a good elementary introduction to the physics of the nucleus.

It should be remarked that a number of statements still occur which might be questioned by advanced students of the subject. This is doubtless not an easy fault to avoid, however, for few of us can hope to become experts in more than one or two lines. Perhaps users of text-books should form the habit of not relying too strongly upon incidental statements without checking their validity by reference to more advanced treatises.

The book constitutes, as it did in its original form, a good introduction to the entire field of electricity and its applications. It is designedly more elementary on the theoretical side than the standard text of Page and Adams, but the treatment is careful, thorough and easily understood. Ample lists of problems are included.

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A BIBLIOGRAPHY OF AVIATION MEDICINE

A Bibliography of Aviation Medicine. By Ebbe Curtis Hoff and John Farquhar Fulton. 237 pp. Charles C Thomas. $4.00.

A timely and much-needed bibliography of aviation medicine has been prepared by Ebbe C. Hoff and John F. Fulton, of the Department of Physiology of the Yale School of Medicine. This work was done under the auspices of the National Research Council Committee on Aviation Medicine, acting for the Committee on Medical Research of the Office of Scientific Research and Development. It is now available for investigators in this country. The labor has been extensive, as there are over 6,000 citations from 800 journals. References are well classified according to subjects and there are many cross references, for example, 107 under "Hemoglobin."

Unusual care has been taken with make-up and typography and the George Banta Company deserves much credit for the press work. This carefully prepared, comprehensive bibliography will prove invaluable not only for investigators of aviation physiology and medicine but also for the many physiologists working in related fields.

Eugene F. Du Bois

SPECIAL ARTICLES

THE ABSORPTION AND DISTRIBUTION OF INSULIN LABELLED WITH RADIO-ACTIVE IODINE[1]

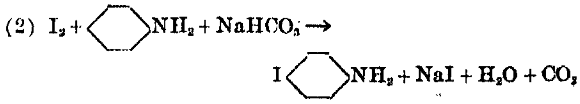
THE measurement of the absorption rate of insulin from the site of depository injections is of practical interest. While it is usually estimated by its indirect effect on the blood sugar level, Beecher and Krogh[2] have studied the absorption of insulin after an injection of protamine insulin into a rabbit's ear, using methylene blue as a tracer. The distribution of insulin in the body has been studied only by determining the insulin content of blood and pancreas by the insufficiently accurate method of extraction followed by biological assay. Since biologically active and crystalline insulin derivatives have been prepared containing heavy atoms, as iodine and arsenic,[3] it became possible to prepare a radioactive insulin derivative containing radioactive iodine. We have attempted to follow the absorption and distribution of insulin after injection, by using insulin-p-azoiodobenzene containing about 2 azo groups per insulin molecule.

EXPERIMENTAL

We were faced with the problem of introducing a sufficient amount of radioactivity with the smallest number of iodobenzene azo groups into insulin so that the resulting derivative be as nearly similar to insulin as possible and yet have sufficient radioactivity for measurement in the small amount of insulin which is tolerated by the experimental animals.

Preparation of Iodoaniline. Morton's[4] micro technique was used in the synthesis of iodoaniline according to the following reactions:

$$(1)\quad KIO_3 + 5\,KI + 6\,HCl \rightarrow 3\,I_2 + 3\,H_2O + 6\,KCl$$



Radioactive iodine containing isotopes of 8-day and 12.6-hour periods was prepared by the deuteron bombardment of tellurium.[5] The iodine was extracted from the tellurium target by adding potassium iodide as carrier, dissolving it in nitric acid and then distilling into carbon tetrachloride from which it was extracted with sodium thiosulfate. A solution of the radioactive sodium iodide containing less than 30 micrograms of iodine was evaporated to a volume of about 0.05 cc. The iodine was liberated by acidification with hydrochloric acid and addition of an excess of potassium iodate, both the acid and the iodate being contained in about 0.01 cc. A small excess of aniline was added after first making alkaline with sodium bicarbonate and the mixture was stirred intermittently for a half hour. Since the sodium iodide which is formed in this reaction must contain at least half of the radioactivity, iodine was again liberated by the addition of potassium iodate and acid, using about half the amounts of reagents used before. In one experiment this was repeated a third time, this procedure allowing for the introduction of more than half of the available radioactivity.

Preparation of the Insulin Azo Derivative. The mixture was acidified with hydrochloric acid, cooled to 0° and the iodoaniline diazotized by the addition of sodium nitrite. The reaction was practically complete in half an hour. Five mg of insulin dissolved in the minimum amount of N/10 hydrochloric acid were then added, and the solution brought to a pH of from 8–9 for coupling. The solution was allowed to stand for at least an hour and sometimes over night. The insulin azo dye was then precipitated three times at its isoelectric point in the presence of non-radioactive potassium iodide, iodophenol and p-iodoaniline. From this material a solution was prepared containing 80 units of insulin per cc.

Absorption Rate Determination. Ten rabbits were injected subcutaneously with 2/3 units/kg. One or two of the animals were killed at given intervals and the skin at the site of the injection and corresponding parts of the abdominal wall was excised. Blood samples for sugar determination were taken just previous to killing the animals, and at the same time from all the other animals which had not as yet been operated on. Ten mg of potassium iodide were added to the skin samples as carrier and the skin and added iodine oxidized with a chromic and sulfuric acid mixture.[6] After reduction with oxalic acid the iodine was distilled into carbon tetrachloride. The completeness of the recovery of iodine was checked by titration with sodium thiosulfate. Activity measurements on the titrated aqueous solution were made with a Geiger counter.

The technique of following the rate of absorption could possibly be simplified and made more accurate by carrying out the experiment in intact animals and applying the Geiger counter with appropriate filters directly to the site of injection. This technique proved to require a higher specific radioactivity than was present in the preparations originally made.

[1] This investigation was aided by a grant from the Josiah Macy Jr. Foundation.

[2] H. K. Beecher and A. Krogh, *Nature*, 137: 458, 1936.

[3] E. H. Lang and L. Reiner, SCIENCE, 93: 401, 1941.

[4] A. A. Morton, "Laboratory Technique in Organic Chemistry," McGraw-Hill, New York, 1938.

[5] The authors are indebted to Professor Robley D. Evans, of Massachusetts Institute of Technology, and Professor John R. Dunning, of Columbia University, for their kindness in preparing the radioactive iodine.

[6] Joseph G. Hamilton and Mayo H. Soley, *Am. Jour. Phys.*, 127: 557, 1939.

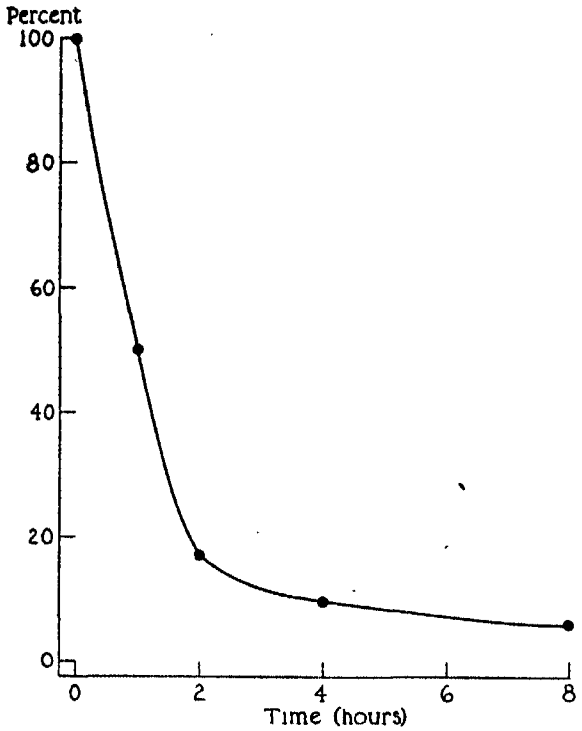


Fig. 1. Per cent. radioactivity remaining at site of injection.

In Fig. 1 the percentage of radioactivity remaining at the site of injection is plotted against time.

In Fig. 2 is shown the relation between the rate of

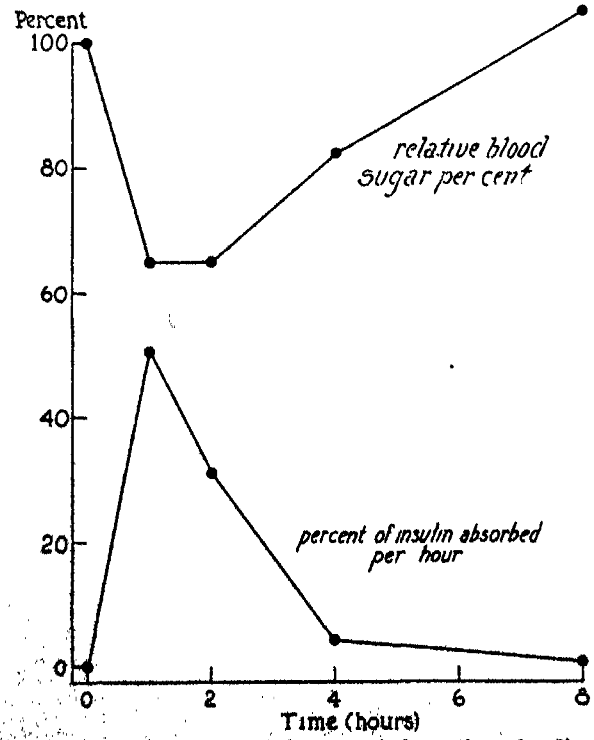


Fig. 2. Comparison of the rate of absorption of radioactive insulin with blood sugar levels.

absorption of radioactive insulin (*i.e.*, the percentage of radioactive material absorbed per hour since the last measurement) and the blood sugar at various times following the injection. From this graph it appears that the time of maximum rate of absorption is soon followed by the maximum drop in blood sugar. Also, as the absorption rate drops to very low values, the blood sugar rises to its original level. There is still a small but measurable activity when the blood sugar has risen to its original level. This may be due to the presence of some denatured insulin.

Preliminary experiments were conducted on the distribution of the radioactive insulin, in rats injected intravenously and intracardially. An hour after injection the circulating blood contained a considerable fraction of the radioactive material. Relatively large quantities of radioactive material were found in the liver and kidneys, suggesting concentration of insulin by these organs.

Since part of the azo groups may be split off from the insulin by reduction in the body, distribution experiments of this type can be of value with regard to the physiology of insulin only if the rate of decomposition of the insulin derivative is also determined. However, as the reduction of azo compounds is relatively slow, it seems probable that in short experiments the distribution of the label would reflect the distribution of insulin in the body.

The technique described above represents a simple means for testing the rate of absorption of insulin depot preparations such as globin and protamine insulin.

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COLCHICINE INDUCED UNIVALENTS IN DIPLOID ANTIRRHINUM MAJUS L.

The spindle inhibiting effect of colchicine in mitosis and meiosis in both animals and plants is well known. However, the extent to which colchicine may affect the chromosomes themselves is less definitely established. Spiralization seems to be influenced by colchicine and a fusion or stickiness of the chromosomes frequently follows colchicine treatment. A low frequency of induced chromosomal aberrations and an altered mutation rate may also result. A disturbing effect on chromosome pairing and crossing over has also been reported. Walker,[1] Levan[2] and Dermen[3] found uni-

[1] R. I. Walker, *Amer. Jour. Bot.*, 25: 280–285, 1938.
[2] A. Levan, *Hereditas*, 25: 9–26, 1939.
[3] H. Dermen, *Jour. Hered.*, 29: 211–229, 1938.

valents a few days after treatment which they attribute to asynapsis or desynapsis. On the other hand, Darlington[4] reports that colchicine induces crossing over in regions where it is normally excluded. Further data on the influence of colchicine on meiotic chromosome pairing is presented in the present paper and the results treated statistically.

Young potted cuttings from a white-flowered clone of *Antirrhinum majus* L. (2n = 16) were treated by immersion in aqueous solutions of colchicine (0.1, 0.15 and 0.25 per cent.) for periods ranging from seven to 42 hours. After treatment the plants were grown in the greenhouse until flower buds were sufficiently developed to obtain pollen mother cells. The time elapsed between treatment and fixation varied from 6 to 15 weeks. Control material was collected from untreated plants of approximately the same age, most of which had been immersed in water while the treated plants were in the colchicine bath.

The number of lagging univalents at first anaphase were scored for one hundred or more cells from each of 30 control and 52 treated branches. The number of cells examined and the percentage of cells with 0, 1, 2, 3 and 4 laggards are given in Table 1. In the

TABLE 1

PERCENTAGES OF CELLS WITH 0, 1, 2, 3 AND 4 UNIVALENTS IN CONTROL AND COLCHICINE TREATED DIPLOID ANTIRRHINUM MAJUS L.

		Univalents					Total number of cells
		0	1	2	3	4	
Controls	Actual.	3765	48	52	0	1	3,866
	Percentage ..	97.387	1.242	1.345	0	0.026	100
Treated	Actual.	6596	96	144	4	1	6,841
	Percentage ..	96.419	1.403	2.105	0.058	0.015	100
	$\Sigma\chi^2 = 9.324$		df* = 2		P = < 0.01		

*There are only two degrees of freedom because the numbers of cells with 3 and 4 univalents are too small to be considered separately and must be added to the two univalent class.

control plants 2.61 per cent. of the cells had one or more laggards, while the treated plants had 3.58 per cent. This is an increase of about 37 per cent. The χ^2 test shows that the probability of a difference of this magnitude being due to chance alone is less than one per cent. (Table 1) or if all the cells with laggards are grouped together the fourfold table test of goodness of fit again shows the probability to be less than one per cent. The increase in number of univalents can, therefore, be regarded as highly significant.

Since the univalents probably result from a decrease in number of chiasmata it can be concluded that colchicine must reduce crossing over in at least one pair of chromosomes. In the majority of the material examined meiosis did not occur until eight weeks or longer after the treatment. This would indicate either that colchicine or colchicine derivatives must remain in the plant for a considerable length of time, or that the treatment alters the structure of the chromosomes to such an extent that normal crossing over and chiasma formation is inhibited in a small percentage of cases. Complete inhibition of all crossing-over has been reported in pollen mother cells examined a few days after treatment. So far as the author is aware no previous reference has been made to such a long-term effect of colchicine on chromosome behavior.[5]

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[4] C. D. Darlington, John Innes Hort. Inst. Ann. Report for the year 1940.

[5] This work was largely done under Bankhead-Jones Project Nos. 3 and 4 at the New York State Agricultural Experiment Station, Geneva, N. Y.

CRYSTALLIZATION OF A PROTEIN FROM POLIOMYELITIS INFECTED MOUSE BRAIN[1]

A FRACTION which is essentially protein in nature has been obtained from the brains of mice infected with poliomyelitis virus. This fraction is birefringent, and the washed material (crystalline or liquid crystalline) is infective, producing typical symptoms of poliomyelitis. It was obtained by the following procedure: poliomyelitis infected brains were frozen and kept in a box with dry ice. Throughout the procedure the temperature was maintained at or below 0° and all manipulations were carried out under sterile precautions. Groups of between 10 and 15 brains were thawed and then extracted twice with saline 1:10 for one hour at pH 7.8. After centrifugation for 30 minutes at 2,500 R.P.M., the supernatant fluid was shaken with an equal volume of ether, which was added in small portions to the brain extract in a separatory funnel. Complete separation usually occurs after 6 to 8 hours in the refrigerator. The lowest layer in the separating funnel is only slightly opalescent and contains most of the virus.[2, 3, 4] From this layer, after separation, ether was removed by negative pressure. The solution was adjusted to pH 4.0 with N acetic acid and centrifuged. The supernatant (I) was kept separate. The precipitate was resuspended in saline, the pH adjusted to 8.0, thoroughly mixed with a glass rod and again centrifuged (supernatant

[1] Aided by a grant from the National Foundation for Infantile Paralysis, Inc.

[2] B. Howitt, *Proc. Soc. Exp. Biol. Med.*, 28: 158, 1930.

[3] M. Schaeffer and W. Brebner, *Archives Path.*, 15: 221, 1933.

[4] P. F. Clark, A. F. Rasmussen and W. C. White, *Jour. Bact.*, 42: 63, 1941.

II). Supernatant I and II were mixed and kept in a dry ice-box. The extracts obtained by the above procedure from several groups of infected brains were combined. This mixture was precipitated with 1.6 M ammonium sulfate at pH 7.0. The mixture was centrifuged and the precipitate discarded. The supernatant was then reprecipitated at pH 5.6 with 2.3 M ammonium sulfate and left for two hours in the refrigerator. The centrifuged precipitate was suspended in physiological saline and dialyzed in a Cellophane tube against saline for three days. The saline was changed every few hours. The dialyzed solution was brought to a pH of about 4.3 with n/10 acetic acid and the centrifuged precipitate discarded. To the clear, colorless supernatant n/100 acetic acid was very carefully added, drop by drop, until a first precipitate appeared. This precipitate was examined under a polarizing microscope and was found to consist partly of birefringent matter. One of these conglomerates was separated, washed in n/1000 acetic acid and dissolved in a small amount of dilute NaOH. It dissolved with difficulty. It proved highly infective for mice, producing typical paralytic symptoms of poliomyelitis after intracerebral inoculation in 14 to 72 hours. Another group of mice treated with omission of the ether extraction and with slight modifications of the above-mentioned method gave a somewhat better yield of the crystalline material. The data on this latter method are, however, still incomplete.

Another conglomerate was separated under the polarizing microscope and an x-ray diffraction photo of the wet material was taken by Dr. Fankuchen. It showed, in addition to some undifferentiated low angle scattering, a distinct though diffuse halo at an angle corresponding to about 4.5 Å. A halo of this character seems to be characteristic of protein material.[5, 6]

As encouraging as these data are it must be stressed that there is no evidence and no claim that the crystalline material obtained by this procedure represents the poliomyelitis virus. The possibility that the virus is adsorbed on the protein can not be excluded.

The author is under deep obligation to Dr. I. Fankuchen for his encouragement and advice as well as for the x-ray diffraction photograph.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

ON A NEW PROTEASE FROM PILEUS MEXICANUS[1]

Pileus mexicanus is an arboreous plant about eight meters high, belonging to the family of the Caricaceae; it grows wild in different states of Mexico (Morelos, Guerrero, Colima, Campeche y Yucatan), and is commonly known as "cuaguayote." From fruits and leaves a latex is obtained that has great activity, similar to that of papaya. The latex, collected by making longitudinal incisions on the fruits, clots rapidly, becoming brownish yellow in color.

After drying the latex in vacuum at 45° C it becomes easy to pulverize, yielding a white powder, similar to pulverized papain.

The enzymatic activity was determined by the milk-clotting method (Balls and Hoover)[2] and by titulation with alcoholic KOH (Willstätter, Waldschmidt-Leitz, modified by Balls).[3] Table I shows the activity obtained.

The corresponding values obtained by Balls for raw papain[4] in milk-clotting units are 1.11 after activation with Na CN and 1.09 non-activated per mg of latex. By titulation with alcoholic KOH, the maximum activity obtained by Balls on 5 mg of raw papain is 1.00 cc after activation with H_2S. These values show that this enzymatic preparation has a slightly superior activity to papain.

TABLE I

Mg of enzyme	Activator	pH	Clotting time in seconds	Milk-clotting units	cc of alcoholic KOH
1	None	4.6	60	1.00	....
1	Cystein 0.05 M.	4.6	50	1.20	....
5	None	4.7	..	....	1.10
5	H_2S	4.7	..	....	1.35

Similarly to other enzymes of the papain type, it is activated by HCN, H_2S and cystein, and rendered inactive by H_2O_2 and I_2. However, the papain clots the citrated blood, while the protease from Pileus does not. Its antihelminthic power was tried on *Ascaris lumbricoides, Macracanthorhynchus hirudinaceus, Oxyurus equi* and an Ankylostomid, being strongly positive in all cases.

The control specimens, in boiled enzyme, remained alive eight hours after the experiment was begun.

[1] Syn. *Jacaratia mexicana* (Sessé et Moc. ex D.C.); *Pileus heptaphyllus* (Sessé et Moc.), Ramirez; *Leucopremna mexicana* (Sessé et Moc.), Stanley.

[2] A. K. Balls and S. R. Hoover, *Jour. Biol. Chem.*, 121: 737, 1937.

[3] A. K. Balls, T. L. Swenson and L. S. Stuart, *Jour. Assoc. Off. Agr. Chem.*, 18: 140–146, 1935.

[4] A. K. Balls, H. Lineweaver and S. Schwimmer, *Indust. and Eng. Chem.*, 32: 1277, 1940.

[5] J. D. Bernal, I. Fankuchen and M. Perutz, *Nature*, 141: 523, 1938.

[6] I. Fankuchen, *Annals New York Acad. Sciences*, 41: 157, 1941.

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TABLE II

ANTIHELMINTHIC ACTIVITY ON ASCARIS LUMBRICOIDES FROM INTESTINE OF THE PIG. (pH 5, BUFFERED WITH CITRIC ACID AND DISODIC PHOSPHATE, AT 40° C)

Enzyme concentration	2 hours	4 hours	8 hours	24 hours
1 per cent.	An ulcer attaining body cavity	Partial digestion	Intense digestion	Total digestion
0.5 " "	Several ulcers	Incipient digestion	Partial digestion	Total digestion
0.1 " "	No change	Several ulcers	Incipient digestion	Partial digestion
0.05 " "	No change	No change	Several ulcers	Partial digestion

The fresh latex and dry weight relation is 30 per cent., while in papain it is only 20 per cent.

Pileus mexicanus is quite abundant in Mexican tropical regions, making its industrialization possible, to compete with papain. Methodic breeding of the plant would be an important source of the enzyme. We propose the name of "mexicain" for this enzyme.

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FUNGICIDAL VALUE OF THE SALICYLATES

THE problem of finding suitable substitutes for copper fungicides is becoming increasingly important. In recent discussions, prominent mention has been made of such organic compounds as phenothiazine, tetramethyl thiouram disulfide and ferric dimethyl dithio carbamate. However, one of the major needs for copper fungicides is in the control of various downy mildew diseases (caused by species of *Phytopthora*, *Peronospora* and *Pseudoperonospora*), and information as to possible copper substitutes in this field appears to be lacking. During the past ten years, the Bureau of Plant Industry, in cooperation with the state experiment stations of Georgia, South Carolina, North Carolina and Maryland, has conducted an extensive search for sprays effective against the blue mold or downy mildew disease of tobacco. The organic compounds mentioned above have been tested along with numerous others. Most promising results have been obtained with the salicylates, practically all of which were more or less effective. The best of these compounds so far tested has been bismuth subsalicylate, used at the rate of 1½ pounds, plus 1 pound of Vatsol O.T.C. (sodium dioctyl sulfosuccinate) in 100 gallons of water. With the aid of the wetting agent, the subsalicylate makes a quick and stable suspension, and the spray adheres very well to tobacco leaves. This spray used against blue mold has given excellent control, with strong residual protection after spraying was discontinued, and no plant injury. It has been superior to the regular copper oxide-oil in all three respects, and the copper oxide-oil has, in turn, been much superior to bordeaux mixture. The second best of the salicylate mixtures so far developed has been benzyl salicylate, one fourth pound dissolved in 1 gallon of cottonseed or soybean oil, emulsified and diluted to 100 gallons. This mixture has been very effective, but has occasionally caused plant retardation, and it does not have quite the residual protection of the previous. Salicylic acid and zinc salicylate at the rate of one half pound dissolved in 1 gallon oil, emulsified and diluted to 100 gallons, have been effective fungicides, but likely to cause plant injury. Materials showing some promise are butoxyethyl salicylate, dinitrosalicylic acid and salicyl salicylic acid, all at the one half pound rate in oil. So far, most of the salicylates do not appear to be critical materials, but difficulties regarding availability and price may be expected. It would seem most important to find out as soon as possible what fungicides can be used against each specific disease, and it would not be surprising if very much improved spray treatments would ultimately result.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE AMOUNT OF OIL TAKEN UP BY SAND

How much oil can an oil sand take up? This problem is of importance not only to the petroleum geologist but to the physicist, chemist and botanist.

The answer is given by Dr. Edward Kasner, professor of mathematics at Columbia University, in a report to the American Mathematical Society. If the grains are perfect spheres, all equal, he says, then for the closest packing 25.955 per cent. of the whole space will be vacant, and can be filled with oil or other liquid; while 74.055 per cent. will be occupied by the sand. This result can be tested experimentally by filling a box with sand and then seeing how much water can be poured in.

The proportions of occupied and unoccupied space will be the same whether the spheres are large or small, provided they are all equal. But if they are unequal, and suitably arranged, then a larger portion of the space can be occupied by the sand, and consequently less oil or water taken up.

This may easily be visualized if we pack a box with oranges. Between the oranges we might insert nuts, between these and the oranges we might get in some peas, and in the spaces still vacant fine shot, and so on until we get down to the finest powders. Thus we would fill up more and more of the space. Mathematically this could go on forever—an infinite series of spheres—of diminishing size. Practically we have to stop with the smallest particle that can be handled. Experiments with mixed sands have in fact succeeded in reducing the vacant space to a few per cent.

It is obvious that spheres, however packed, will have small gaps and therefore space can never be filled 100 per cent. But by a suitable arrangement 99 per cent. can be filled or 99.999 per cent. or as near 100 per cent. as desired. The work is purely mathematical since we are dealing with ideal perfect spheres. In a similar way the plane can be covered with circles (coins or discs of various sizes).

The full mathematics, Dr. Kasner said, will shortly be published in a technical journal.

METALS

How minute cracks, porosity and surface blow holes in metals, invisible to the eye and to x-rays, can be beautifully shown up by use of a fluorescent dye and ultraviolet light was exhibited at the Cleveland meeting of the American Society for Metals by Taber de Forest, research engineer of the Manaflux Corporation of Chicago.

The method is far more sensitive, Mr. de Forest said, than the old kerosene and whitewash method that has been used for this purpose. The liquid which carries the dye penetrates the minutest cracks by capillary attraction, and is washed off from the rest of the surface by plain water. It is true that either of these methods reveals only cracks that reach the surface, but deep-seated defects are often connected with the surface by a network of capillary cracks. Fatigue cracks, it is known, originate on the surface, and shrinkage cracks of castings often appear there. Besides, a small crack is often the starting point of a later failure. These small cracks are not revealed by x-rays because a relatively spacious void is necessary to show up on an x-ray picture.

A simpler and faster method for observing the rate at which one solid metal diffuses into another, an important matter in many practical fields, was described at the same meeting by Howard S. Coleman and Henry L. Yeagley, of the Pennsylvania State College. An extremely thin film of the one metal was condensed on the surface of a microscope slide, and a similar film of the other metal deposited on top of it. Such extremely thin films are semi-transparent. The reflecting power of the contact surface between the two metals was measured and recorded continuously by a photoelectric method, using a powerful automobile headlight as a source of light. As the one metal diffused into the other, the reflecting power of the surface diminished, and was shown by a drooping curve. Under some circumstances a test can be made in as little as five minutes.

NEW STANDARDS ADOPTED FOR TOTAQUINE

DR. E. FULLERTON COOK, chairman of the committee of revision of the U. S. Pharmacopoeia, reports that new standards will soon be officially announced for the anti-malarial, totaquine.

The medicine is a mixture of substances, including quinine, obtained from "Jesuit's Bark." This mixture has the same action against malaria as quinine, but has been little used in this country. Lowering the quinine content to 7 per cent., results in fuller use of South America barks which analyses show average only 1 per cent. quinine. This does not include about a fourth of the bark samples which contained practically no quinine. They contain the other anti-malarial substances, however, which it is believed can be just as effectively used as quinine. The former standard required 10 per cent. quinine or more. Now a ceiling of 12 per cent. will also be included. This presumably was adopted to insure uniform results in treatment and to prevent conflicting therapeutic claims and price differences. Authorities feel that these would be unjustified merely on the basis of one preparation containing more quinine than another.

Another requirement that at least a fourth of the product be cinchonidine and cinchonine will be completely dropped. The lower limit of 70 per cent. total crystallizable alkaloids will have a ceiling of 80 per cent. in the new monograph.

The new standards will be maintained, Dr. Cook explains, for at least the "duration" while the maximum use of anti-malarial supplies is necessary due to exposure of our troops to the fever and the cutting off of our usual imports from the Far East.

The consensus of opinion expressed by experts on tropical diseases at a recent conference called by the National Research Council in Washington is that totaquine is equal to quinine in efficiency in treating malaria.

HOUSING AFTER THE WAR

ABOUT a million new homes per year could be used by Americans during the decade following the war, if they are built in the right places at the right prices, it is estimated in a report issued by the National Resources Planning Board. Besides this there will still be a need for a large volume of repair during the same period.

This potential boom in home building has developed because only three new dwellings have been built for every five additional families that have been formed during the last decade, and because of the drastic curtailment of housebuilding during the war years.

War time housing will take care of only acute needs, according to Miles L. Colean, author of the pamphlet released by the Board. It is also likely, he says, that many war dwellings will not be in the areas where they will be needed after the war. Meanwhile, out-dated and worn-out houses throughout the country continue to deteriorate.

If we had better means for providing attractive, low-priced houses, according to the report, a huge demand would exist for the replacement of these deteriorated and outmoded dwellings amounting perhaps to as much as a fifth of the total stock of about 37,000,000 dwellings, or somewhat over 7,000,000 units ripe for replacement. About 2,000,000 of these are needed on farms alone.

Continued research in materials and techniques is recommended as one of the long range methods of solving this housing problem. This statement recalls plans by some authorities for standard models of houses. They believe this would be a big help, just as standard auto models have made new cars available to most families in the past. These houses would roll off assembly lines in mass production to be assembled in sections with a minimum of expensive "custom tailoring" at the building site. New building materials are also likely. Some foresee the use of plastic-and-plywood walls with a stainless steel roof. Such a house would be strong yet so light that two men could lift the whole wall of a room as they put it up.

Application of scientific research should bring prices down to where the new homes could be constructed all over the country by the hundred thousand. Price has been the main drawback in the past, although it is being steadily reduced. In 1925, dwellings were built for around $4,800 per unit, while in 1940 the average price was down to $3,700.

Other steps outlined in the report as possible aids to accelerating the postwar building program included removal of legal restraints within the house-building industry; preparation of model building codes by the government based on ample engineering service and providing localities with facilities for consultation and testing; and improvement of present government aids for providing adequate housing for Americans.

ITEMS

A CALL has been issued from the Society of American Bacteriologists for motion pictures to aid in wartime teaching. With accelerated courses and shortage of teachers at many colleges, it is believed motion pictures on bacteria, rickettsiae, viruses, fungi and animal parasites would be helpful in stopping the gap. The society has appointed a committee, under the chairmanship of Dr. Harry E. Morton, of the School of Medicine of the University of Pennsylvania, to collect information on the usefulness and availability of such films.

THE acoustic movements of the human ear drum have been seen and photographed for the first time. Moving pictures showing these movements of normal ears and also of ears of patients suffering from deafness were shown by Dr. H. G. Kobrak, of Gary, Ind., and Dr. J. R. Lindsay and Dr. H. B. Perlman, of Chicago, at the Chicago meeting of the American Academy of Ophthalmology and Otolaryngology. Fresh specimens from human cadavers were used. The various parts of the sound conduction apparatus were exposed and the vibrations during the conduction of sound were photographed. On stroboscopic illumination acoustic vibrations of the ear are seen as distinct and slow movements.

A NEW discovery, which may lead to more complete knowledge of our protohistoric North American ancestors and help bridge the 10,000-year gap in archeological knowledge, has been made by Dr. Frank H. H. Roberts, Jr., of the Smithsonian Institution. A bison wallow, two or three thousand years old, which Dr. Roberts excavated in eastern Wyoming, uncovered a number of spear points known as "Yuma points" and formerly thought to date back to the oldest known inhabitant of North America, the Folsom man who lived at the end of the last Ice Age, 10,000 to 20,000 years ago. This new discovery, however, places the Yuma points at a much later date, somewhere between Folsom and modern.

OWNERS of oil burners who are able to secure a wood supply will be able to substitute wood for oil, according to an announcement made by William L. Slate, director of the Connecticut Agricultural Experiment Station. As a result of research in cooperation with Yale University and the University of New Hampshire, the station has developed a wood-burning unit which can be built out of firebrick by any good mechanic and connected with an oil heater of the convertible type. Wood in the fuel magazine is carried by gravity to the combustion zone, where it is distilled with gas. After introducing secondary air, the gas passes into the furnace and burns at high temperature. This emergency unit holds a tenth of a cord of wood, which is sufficient to heat a ten-room house for 12 hours in cold weather without further attention. The only metal part required is the cast-iron door and frame, for which arrangements are now being made. A special bulletin giving the details of construction and operation may be secured from the station or from the Connecticut Forest and Park Association, P. O. Box 1577, New Haven, Conn.

SCIENCE

VOL. 96 FRIDAY, OCTOBER 23, 1942 No. 2495

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE CHEMIST IN THREE WARS—II

By OTTO EISENSCHIML

PRESIDENT, SCIENTIFIC OIL COMPOUNDING COMPANY, CHICAGO

THE PRESENT WORLD WAR

Now that we are in the midst of the second World War, what is the set-up among chemists for support of the war effort? Have we organized our forces so that they can be and are being utilized in the best possible manner?

I wish I could answer this question in the affirmative.

The top government agency created for scientific war work is the Office of Scientific Research and Development, headed by Dr. V. Bush, president of the Carnegie Institution of Washington. This office can both initiate war projects or solve them; in practice it also functions in an advisory capacity. Much actual work is being performed under the direction of the National Defense Research Committee, of which Dr. James B. Conant, president of Harvard University, is chairman. This committee has two chief divisions pertaining to our line of work, that of chemistry and physics; organic problems are in charge of Dr. Roger Adams, of the University of Illinois, inorganic and industrial chemical matters are under the direction of W. K. Lewis, of the Massachusetts Institute of Technology. The National Inventors Council, under C. F. Kettering, is designated to sift novel thoughts submitted to it. Some problems, which are military secrets, have been assigned to government controlled laboratories; there is no doubt that these tasks are being handled well, and under fine leadership.

So far, so good. What we need next is a complete roster of all chemical talent in the country; such a

roster would make the over-all picture look promising. Right here, however, is where the first flaw begins to show. Our national roster is not complete, nor nearly so; yet, without a complete card index, our top agencies are like an army without an inventory of its manpower. An incomplete list of our chemical talent is about as useful as a telephone directory with half its pages missing. In our directory, I am afraid, even the information that has been listed is not sufficiently accurate.

The preparation of a complete roster to cover our entire chemical brainpower must be based on two indispensable conditions. For one, we must have a questionnaire which is worded right; second, this questionnaire must reach everyone who has useful knowledge or ability. I regret that, in my opinion, neither of these two conditions has been met by the national questionnaire nor any other I have seen.

The questionnaire sent out by the American Chemical Society in October, 1940, to form part of a "National Roster of Scientific and Specialized Personnel," and sub-titled "Jointly Administered by National Resources Planning Board and United States Civil Service Commission," inquired thoroughly into routine qualifications; in fact, it bore a close resemblance to an application blank. Much stress was put on scholastic background, publications and similar matters, when it might have been advisable to go more deeply into qualities particularly useful in war, such as chemical work performed during the last war and, still more essential, into the type of mind possessed by the registrant, whether inventive, inquisitive, supervising or routine. The statistical information derived from a roster compiled by present methods is scarcely adequate to allow an opinion of a man's capacity in a national emergency. We may learn from it that a man's height is five foot eight, but we do not learn if he is resourceful; we may find that he can read French, but we wonder if he is persevering or tires easily. We are informed how old he is, but not whether he is an organizer or a routine worker. At a time when speedy chemical action may be as decisive as in a commando raid, the questionnaire digs into positions held in the past, instead of asking, "What can you do *now,* and where do you think you fit in best?"

All in all, the picture of the registrant that emerges from this national questionnaire is far from illuminating.

The gravest fault I find with this questionnaire, however, is that it did not reach and was not designed to reach every one willing and able to render chemical service. Neither the American Chemical Society nor other organized groups of chemists comprise all members of the profession. Some independent thinkers—and they are not the least valuable—shy away from membership in any group; others are staying on the sidelines for reasons which do not matter. Fact is that many chemists do not belong to existing groups, and so long as they are not included in questionnaires, our rosters will remain incomplete. A close coordination of all our mental resources means regimentation, voluntary and temporary, but regimentation, nevertheless; and unless regimentation is thoroughgoing it is a failure. I believe therefore that a special effort should be made at once to add to our home front all men of chemical training or ability who do not belong to organized chemical groups. Their patriotism is as unquestioned as ours, and they will no doubt cheerfully join us, if and when approached.

Furthermore, we can not afford to overlook those who have no chemical degrees or formal schooling. Some of our best inventive minds received little or no college training, but have within them that spark which no amount of education can supply. Heaven help us if we close our doors to the Thomas Edisons and William Hoskinses, who never saw the inside of a college. In wartime the emphasis is on achievement, not on learning and degrees. When we need a war song, we turn to the man who can write a tune, whether or not he has a diploma from a musical academy. On the battlefield a sergeant who can move a gun across a swamp is worth ten officers who know Napoleon's Egyptian campaign by heart. One of the finest chemists with whom I have worked graduated from a little-known pharmaceutical college; and I have two men on my staff who never had more than high-school training, but whose tangible achievements have made history in their particular field. One of our partially trained chemists has worked out a special oil which increases its technical value manifold. Yet, he has no college degree, and for obvious reasons his work has not been and probably will not be published. If he were to fill out a questionnaire, the column "Publications" would remain blank, thus creating an erroneous impression. Incidentally, none of the three men I have mentioned belongs to the American Chemical Society or to any other chemical organization; their names are on no roster, local or national, nor have they been given any opportunity to register.

This leads us to another weak spot in our armor. A tendency prevails in some circles to undervalue our collateral artisans. Nevertheless, without them the industrial chemist would be helpless. I once had a foreman who could take a few pipes and couplings and turn them into almost any kind of apparatus I needed. I would like to see him on the roster. Perhaps we ought to enlarge the circle of our coworkers still further. I have known ordinary laborers, whose power of observation and interest in their work have been responsible for vast improvements. These élite

of workmen are potential shock troops of industry, and in war-time should be placed where they can do the most good. They should no more be allowed to work in non-essential lines than a chemist should be permitted to drive an army truck.

A new questionnaire, recently prepared by the Defense Committee of the Chicago section, American Chemical Society, contains two questions that intrigue me:

1. Are you of an inventive turn of mind? What have you invented? List even little improvements you have sponsored.
2. Give names and addresses of people you know (not members of the Chicago section) with unusual ability in any collateral work.

At last we are getting somewhere. Not only will Chicago obtain essential information from its own members by asking these pertinent questions, but it will create a real census of many other worthwhile minds in our line of work. Chicago will be able to put its fingers on those who possess unusual ability in collateral fields, whether it be glass blowing, mechanics, photography, repair work or any of the other talents and skills that are called into play in industrial war work.

Nothing that I have said should be misconstrued into an expression of disrespect for pure chemistry. Many problems, if they are to be solved, call for the highest kind of chemical training and require large, well-equipped laboratories. Cracking processes or condensation plastics could not have been developed by poorly trained chemists in basement workshops. Germany never would have achieved her early superiority in dyes and pharmaceutical products without an army of well-schooled men; nor could we have accomplished what we have done in the last twenty-five years without equally fine research chemists and organizations. On the other hand, we should recognize that many problems can well be attacked by practical men with the meager means at their disposal and by simple and direct methods. With the growth of chemistry, subdivisions among chemical workers have developed both vertically and horizontally; horizontally—in different fields; vertically—different grades of men in each field. As in our armed forces, there should be no feeling of superiority or jealousy between different branches of the service, or between the officers and soldiers in each of them. Just as the Army, Navy and the Air Force, and within them all personnel from generals to kitchen police, must cooperate to the fullest extent, so pure scientists, industrial chemists and practical workers in all chemical lines must join wholeheartedly in their efforts to achieve the best results. To disregard this principle is to nullify everything we are trying to accomplish.

It is highly regrettable that we have not proceeded very far beyond the creation of the Office of Scientific Research and Development and the National Inventors Council. What we need badly are local organizations throughout the United States to supplement those of national character so as to put a broad foundation under them.

In this respect remarkable work has been done by Robert C. Brown, Jr., a patent attorney of Chicago. He recognized the need of technical organization for our war effort as early as 1940 and, almost single-handed, translated his ideas into accomplishments, by founding the Associated Defense Committees of the Chicago Technical Societies, in which twenty-three technical and engineering bodies are represented. Over seven thousand scientists, technologists and production engineers in the Chicago area now cooperate through a committee of delegates. A working plan for complete cooperation between the local office of the War Production Board, the Chicago ordnance district and other Government agencies on one side and the Associated Defense Committees on the other is already partially in operation, with Mr. Brown furnishing the connecting link through his appointment as consulting director of the Technical Development Section of the Chicago Region of the War Production Board. This gives the Associated Defense Committees at least a semi-official status and means an important step in the right direction.

Milwaukee and South Bend also have organized Associated Defense Committees, and plans are under way to form similar committees all over the United States. Eventually a National Associated Defense Committee will assume leadership of the entire movement and coordinate the efforts of the local sections.

That all this important work should have been left to the unselfish patriotism, the vision and the energy of one man, is something I admire, but do not understand. While he has accomplished a Herculean task, we as a country still find ourselves far from our goal. We do not want to achieve a perfect national organization of chemists and other scientific or technical brains after the war is over. We want it now and should have wanted it yesterday and the day before yesterday. No matter how well single localities may be functioning, their numbers are puny when we consider the picture as a whole. Wars are won by armies, not by isolated units.

Why no national organization of this kind has been formed to extend fully into local spheres, I do not know. We have before us the example of the Army with its local draft boards and of our political parties with networks covering each precinct in every district. Unless we bring cooperation of all technicians likewise down to the grass roots, we shall have fallen

short of the primary requisite of our duty: we shall have failed to mobilize our full power, and this means that we shall be unable to put it to concentrated use when most needed.

Local boards must be created immediately, if we are not going to be too late, and they should be organized after a standard pattern. Uniform rules must necessarily be worked out at headquarters. Questionnaires should be drawn up with the utmost care and with appeal to our three distinctive groups, the scientific chemist, the industrial chemist and the practical man. I would hold each local group responsible for enrolling all workers within its district. I further recommend that government inspectors call at all plants to insure complete enrolments. So far as chemists are concerned—I am using the word in its widest sense—we are still trying voluntary cooperation; but in every previous war voluntary systems have given way to enforced draft, because the voluntary systems have never worked satisfactorily in the long run. Had we not best anticipate the inevitable? Time is getting short.

The present war has not yet produced anything startlingly new from the chemist's point of view. Nevertheless, there is plenty of chemical work in sight. Among many other things we must now, strangely enough, do what German chemists had already learned to do in the last war—work out substitutes. Twenty-five years ago we had command of the seas and the world's resources, while Germany was blockaded. To-day it is we who are blockaded in regard to some vital war materials. Hence, American chemists are called upon to use their ingenuity to supply the country with substitutes.

I use the word "substitutes," because it is generally used; but it is not a desirable expression, smacking as it does of the German word *Ersatz;* it carries with it an overtone of disdain, an implied apology, an intimation that what we are offering is something to be used only until something better is developed. Yet, a substitute may be better than the original article, as when we use silver in place of copper. What we are really looking for are not substitutes at all, but replacements. This word carries no stigma, and we all understand that a replacement article may be inferior, equal to, or better than the standard material.

This replacement question needs much clarifying. Most of all, it should be generally understood that a replacement product need not be identical with, or even similar to the article it replaces; all it is expected to do is to answer the same purpose.

"Is Oiticica oil a substitute for tung oil?" I have been asked time and again.

"Is a detective story a substitute for a movie?" I have countered. "If you want a couple of hours of light entertainment, yes; if you want to hold a girl's hand, no."

A pair of cotton stockings is not a substitute for silk hosiery, but a replacement, better in some respects, worse in others. As dessert, apple pie may be a replacement for ice cream, unless you are looking for something to cool your insides. I think all chemists have a clear picture of the issue, but the general public needs enlightenment; for once this elementary analysis of the substitution problem is understood, many questions, now hazy in the public mind, will lend themselves to more intelligent discussion. Take the subject of "rubber substitutes," for instance. The daily press is full of it and treats the question as if rubber substitutes, meaning the duplication of natural rubber by synthesis, were the sole answer to the problem. We hear that the total consumption of rubber in the United States is 800,000 tons, and therefore it is taken for granted that 800,000 tons of synthetic rubber must be produced to reestablish the normal balance between production and consumption; even the Baruch-Conant-Compton report apparently takes this view. Yet, I wonder if events will not prove that those who subscribe to it have missed a salient point. If every one understood that what we must do is replace rubber, not duplicate it, many of our experts might revise their figures. Rubber is used for any number of purposes, from bathroom mats and dress shields to the inner tubes of tires. But every one knows that a bathroom mat can be replaced—not substituted—by a cotton rag; in dress shields oiled silk will do very well; but for inner tubes we probably will need natural or synthetic rubber.

What becomes of our 800,000 tons of synthetic rubber when we look at the situation with a view of replacement instead of substitution? Let us assume for argument's sake that normally one per cent. of all rubber goes into bathroom mats and one per cent. into dress shields and other sanitary accessories; by replacing it with cotton rags and fabric impregnated with drying oils, respectively, we already have cut these 800,000 tons by 16,000 tons a year. Does it not seem reasonable to think of replacement in other lines where rubber is used now, before burying ourselves in a statistical avalanche?

Here is where our chemical organization could function rapidly and successfully. The mere breaking down of the rubber question into components, emphasizing replacement rather than substitution, would make the whole problem appear at once much less formidable. The National Defense Research Committee, with the help of all local committees, should separate all uses of rubber into special groups, with a clear analysis of the purposes for which each

article serves. The more thorough the subdivision, the more useful it will be. We know that rubber is by no means an all-around perfect material. It is affected by sunlight, heat, air, oil, steam. Many of its good qualities do not matter at all for some purposes; neither bathroom mats nor dress shields have to snap back when stretched—and there is no reason why they should be stretched. Rubber has been used for many articles as a matter of habit or on account of price. For purposes of replacement all that is necessary is to draw up intelligent and thorough specifications for the proper material wanted, without mentioning rubber at all, and many problems that look difficult will become simple. What we need for dress shields, for instance, is not rubber, but a waterproof material that can be used to impregnate a fabric without damaging it; it must be light in weight, reasonable in price and resistant to the excretions of the human body. That is all. A properly oiled fabric will not only answer these specifications, but may outperform rubber. I am willing to go on record that when this war is over, rubber will not come back into many fields in which it has reigned supreme up to now. Like other undisputed champions, it may lose its crown, once its supremacy is seriously challenged.

An intelligent and minute subdivision of the uses to which rubber is put and for which replacement is desired, is essential. Take the subject of rubber gaskets, for example. Entirely different specifications will have to be drawn up for gaskets used in plumbing and those used on fruit jars; but even the specifications for fruit-jar gaskets will differ according to what is inside the container. A jar containing pickles will call for a type of gasket different from a jar containing mayonnaise. The great advantage of a thorough subdivision is that each replacement material need only cover a small range, and that within this small range it may easily be better than rubber, without possessing any of the qualities for which rubber is unique. Let us remember that a good shortstop need only be a good fielder and batter; it does not matter whether he is also a good golfer, or whether he can speak Portuguese.

The proper subdivision of our replacement problems is one of the principal tasks for our organized chemical forces, wherever a replacement problem must be attacked. After that it is a matter of distributing the problems into small fractions that are not unwieldy. Each subdivided problem will naturally go to those specialists whose knowledge seems most adaptable for any particular goal. The development of a genuine rubber substitute, in the sense of a synthetic duplication, calls for highly trained research chemists commanding big resources; but the development of replacement products calls for chemists of all kinds, in fact, for technical men of all kinds. Once the rubber question is broken into fragmentary problems which can be easily understood by laymen, it would also be criminal folly to underestimate the service that can be rendered by the intuition, experience and skill of those who are versed in related arts. Excellent solutions may easily spring from individuals who have no knowledge at all of rubber itself.

What holds good for the rubber problem holds, of course, equally for many other shortages with which we are beset; but as the parallelism is obvious, a detailed discussion of other materials is superfluous.

Considerable dissatisfaction exists among many American chemists, because their energy and patriotism has not been harnessed to obviously pressing national needs. Chemists are aquiver to use their ability in the war effort; I am as sure of it as I am that our soldiers are eager to get into battle. Yet, many capable chemists are standing by with nothing worthwhile to furnish them an outlet for their enthusiasm. Is everything chemical in so perfect a condition that we can afford to leave all this potential ability and experience idling around?

Perhaps more problems would be available if we were allowed to hunt them up ourselves rather than wait for the military men to bring them to us. If we chemists were better informed about what is going on at the front, we might be able to initiate new ideas, possibly even one as revolutionary as the first German gas attack. The trouble as I see it is not that we chemists will fail the Army men when they come to us asking questions; the trouble is that they may not know what questions to ask us, and we, ignorant of the situation, are too uninformed to help them.

Let us assume that certain important war materials are being affected by the heat of the Sahara or the fog of the Aleutians. The Army sends out an SOS call; it goes to our National Defense Research Committee, which in turn will immediately formulate the problem into chemical terms and—after completion of the proper set-up—will send it to local boards for urgent action. But meanwhile much time will have elapsed and considerable damage may have been done; for most likely the Army's call will not be sent out until a serious fault has already developed.

In order to expedite the work, or perhaps prevent harm before it has made much headway, why not have chemical observers at our fronts? We have press correspondents, why not chemical scouts? It would be their duty to note the conditions under which military equipment is used in the tropics or in the arctic, and they may advise preventive rather than remedial steps. Even with a complete organization of our chemical forces at home we must, under

existing conditions, cross each bridge when we reach it—if we have a bridge. By receiving advance notice of impending trouble, however, outlined to us by trained observers, we could save considerable time and, conceivably, even prevent a military disaster.

Admittedly, complete confidence in military matters can only be given to a select few; but there is no reason why chemists should not be included among them. The more we chemists know about military matters, the more readily we can cooperate. The German professor who suggested the gas attack at Ypres was not asked for it; but he saw for himself that trench warfare was tending toward an interminable stalemate, and he offered chemical means to overcome it. Presumably, our chemical scouts may likewise originate by themselves chemical measures of either an offensive or defensive nature, which could have a decisive influence on the outcome of the war. So long as we are satisfied to do no more than supply chemical first aid, we shall play a secondary part. Chemists can do better than that, but in order to do so, they must be given an opportunity to be more than advisers.

When and if our organization is functioning smoothly, problems will be submitted to our local boards. Some of these problems will be of a confidential nature, and care will have to be taken that only men are put to work on them whose loyalty is beyond question. I can visualize many other problems, though, which are not secrets and could be posted publicly, so as to give everyone an opportunity to put his brain and skill to work. Let these notices appear in thousands of places, in laboratories, factories, post offices. Or are we too proud to let people know that we are in need of certain improvements? Everybody knows now that we are short of chromium, tungsten, rubber. We are not too proud to call for money in form of bonds; why shy at technical contributions? Cooperation between workers and managements has already produced splendid results. Is there any reason why this cooperation should not be put on a broader basis, including not only working conditions, but also matters of warfare?

This, then, is the set-up I envision to accomplish a complete mobilization of our chemical strength.

First, a supreme chemical council to govern all war work. It should have representatives from all chemical branches, scientists, industrial chemists, practical men, and be subordinated only to a national board of directors, provided such a board exists or will be created.

Second, a large number of trained chemical scouts, keen, imaginative and experienced. They are to gather at the source whatever war problems present themselves, offensive, defensive or remedial.

Third, a nation-wide roster to include all chemical talent, college-trained or not, both inside or outside existing chemical organizations.

Last, chemical groups covering each territory, modeled after a uniform pattern worked out by the national supreme council; these local boards to be in contact with each other as well as with headquarters and to be associated in turn with working groups in collateral fields.

With such a set-up the handling of all chemical problems will be greatly simplified and their solutions hastened. We shall then not only answer questions asked of us, but our scouts at the front will originate questions and formulate them better than would be the case if the reports came to us through military channels.

I have so far spoken mainly of problems submitted to chemists for solution and not of ideas that may originate in chemists' minds. Ideas of this kind are now being taken care of through the National Inventors Council and need not concern the National Council or the local boards.

It is now nearly a year since we were forced into war. An organization of all chemical ability in the country is an urgent necessity. Many chemists are convinced that organization has not proceeded far enough and are unhappy because they feel they are not being given an opportunity to put their shoulders to the wheel. It is for these reasons that I am submitting my suggestions; they may not be the best approach to the goal, but they should furnish a basis for a discussion on how to best utilize our tremendous chemical power, second to that of no other country on the globe, but one which must, like all our other resources, be fully employed.

The Civil War was Business, the first World War was Big Business, and the present war is Super Business of such gigantic proportions that it almost surpasses comprehension. But it is still business. The Germans have learned their lesson, and they have a board of directors, whether or not it functions under that name. That shrewd businessman, who would have used poison gas properly in 1915 to win the first World War, is no longer absent from their council tables. Who else would have suggested building cardboard tanks to be left stranded on the Austrian roads and in the streets of Prague so as to entrap the gullible governments of England and France into a belief that all German equipment was of inferior quality? It is he who has set up an advertising (propaganda) department that works with diabolical ingenuity. His handiwork is visible in a thousand little tricks, none of them calling for genius or even learning, but all calling for shrewdness and cunning.

In this war, for instance, the Germans did not waste their surprise weapons on small objects; when they played their parachute trump, it took Holland.

Some day our over-all management of this war will meet the well-nigh perfect German business machine with a wholly perfect American counterpart. Then everything will be well; as an integral part of the nation's organized brainpower we shall know where we fit in and how we can do our share to achieve victory.

In the Civil War three chemists kept the South in the running until the end; one chemist in the North made the United States independent of the most critical foreign material. In the first World War, a German chemist almost decided the issue in favor of his country through one brilliant thought. Can we, at this critical time, afford to toy with our chemical potentialities and act as if we were preparing for a war five years hence? Our enemies have had the initiative in every theater of this war so far, for reasons that may or may not have been beyond our control. But we have no excuse whatever for letting the initiative slip from our hands in the chemical field; it is an even race, unless we choose to handicap ourselves by dawdling or undue optimism.

We American chemists are quantitatively superior and qualitatively at least equal to the chemists of Germany. If we let them beat us through better organization, we shall have no one to blame but ourselves.

OBITUARY

NORRIS JONES

NEWS of the sudden death of Norris Jones on September 17 causes sorrow to his friends and associates. On account of the variety and excellence of his talents, their influence was much larger than his modest disposition would indicate.

Norris Jones graduated from Swarthmore College in 1926, and was an architect by professional training. His interest subsequently led him to the use of drawing for biological description, and he and his wife, Ruth McClung Jones, were members of the staff in biology of Swarthmore College.

As an architect, Norris Jones knew the proper use of material and, as a scientist, he appreciated how buildings could be adapted to the use of their occupants. His skill and taste are recorded in the suitability of the Edward Martin Biological Laboratory at Swarthmore College for the biologists who work there. The same skill and good taste were used in the projection of plans for reconstruction and for new buildings at the Marine Biological Laboratory at Woods Hole, Massachusetts.

In his work on drawings for scientific use, Norris Jones has illustrated a number of books and biological studies of others as well as his own. The drawings which he made are workmanlike, true and clear. They pick the essential pattern to be presented and show it graphically, but without leaving chance for distortion. His work is true art serving science.

The qualities of clear observation and truthful presentation made Norris Jones a fine associate to work with. Those who penetrated through his modest exterior found in him delightful qualities for friendship. Students who worked with him followed the direction of his fine personal qualities as well as his art and science. The result was a valuable influence upon their characters, which was so strong as to surprise those who had seen only his modesty.

The work of Norris Jones was cut off while in the full strength of development and opportunity. That loss to his colleagues is a great one, for they have come to depend upon his advice and help. But in the buildings which he has projected, the fine illustrations which he has made and in his clear and pleasant influence upon his associates, he has left a recorded accomplishment sufficient to do honor to a long career.

LAURENCE IRVING
EDWARD MARTIN BIOLOGICAL LABORATORY,
SWARTHMORE COLLEGE

RECENT DEATHS

DR. CYRUS F. TOLMAN, professor emeritus of economic geology of Stanford University, died on October 13 at the age of sixty-nine years.

DR. ARTHUR D. HIRSCHFELDER, professor of pharmacology at the University of Minnesota, died on October 11. He was sixty-three years old.

DR. GILMAN D. FROST, emeritus professor of medicine of Dartmouth College, died on October 8 at the age of seventy-eight years.

DR. J. C. SCHOUTE, emeritus professor of botany of the University of Groningen and president of the sixth International Botanical Congress, has died at the age of 65 years. He is known for his numerous contributions to plant anatomy and morphology.

SERGEI CHAPLYGIN, chief of the laboratories of the Aero-Hydrodynamics Institute of Moscow, a member of the Russian Academy of Sciences, died on October 8 at the age of seventy-four years.

SCIENTIFIC EVENTS

THE EFFECTIVE USE OF SCIENTIFIC ABILITY

A PLAN to make productive unused scientific ability in work directing segments of war research problems in the laboratories of the smaller colleges has been initiated by the American Chemical Society. Dr. Charles L. Parsons, secretary of the society, has announced that the unused talents of directors of research who have retired from the universities and industry will be connected with departments of chemistry in institutions where the staff is not sufficiently large or well equipped to carry on research alone. The plan is under the direction of a committee of the society, of which Dr. J. Sam Guy, chairman of the department of chemistry at Emory University, is chairman. Members of the committee are: Dr. William Lloyd Evans, of the Ohio State University, and Dr. Samuel C. Lind, of the University of Minnesota, both past presidents of the society; Dr. Hobart H. Willard, of the University of Michigan; Dr. E. Emmet Reid, professor emeritus of the Johns Hopkins University; Dr. B. Smith Hopkins, professor emeritus of the University of Illinois, and Dr. Stuart R. Brinkley, of Yale University.

The plan is designed to encourage and foster research in American colleges through the use of advisers; it is believed that many unsolved chemical problems could be undertaken under the direction of the visiting professors who have had wide experience in guiding research. Dr. Guy has made the following statement:

> This is no time for any idle "scrap" in chemical research ability to be sitting around. Every man able to direct research in chemistry should be up and at it. Every college teacher, every able college student can do his bit. It is the function of our committee to get these forces together. We must "scrap out" bits of valuable scientific ability and set them to work on new problems.
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> More chemical research is needed as a means of national defense and for the training of future chemists who will be responsible for "better things for better living through chemistry." Many universities and industries, however, have a definite policy of retiring employees at the age of approximately sixty-five years. These emeritus chemists have a vast store of information and inspiration which should not be lost at a time when the nation requires scientific research almost more than anything else.
>
> There are also active directors of research who are eager to spread their influence beyond their individual laboratories. These men have numbers of problems, all a part of one large scheme of research, which they would be glad to farm out to colleges where some wide-awake student of the upper classes would be interested. The problems are not quite large enough for a doctor's thesis but still offer a challenge to men in their senior year. Many students, who would thrill at the taste of research, need leadership which their colleges, for one reason or another, have not been able to furnish.

The feasibility of the program has been proved by the experience of Dr. Reid, who since his retirement from the Johns Hopkins University has been aiding research in a group of southern colleges, and of Professor John Howe Yoe, of the University of Virginia, who has been dividing large problems into smaller units capable of being handled with a minimum of apparatus and material. Last year Dr. Reid, in his circuit of nine southern schools, had more men cooperating in his research program than he ever had at any time while he was professor at the Johns Hopkins University.

The committee will act as a clearing house for research directors who are willing to give their time and for colleges interested in the plan. It is thought probable that industrial research laboratories will cooperate in the program.

CANCELLATION OF THE ANNUAL MEETING OF THE NATIONAL CONFERENCE ON WEIGHTS AND MEASURES

THE annual meeting of the National Conference on Weights and Measures which is usually held in June of each year at Washington, D. C., has been cancelled for 1942 because of unsettled conditions throughout the country and serious congestion in Washington resulting from the war. It is undetermined at present whether future meetings of the conference will be held during the continuance of the war.

The National Conference on Weights and Measures, which is a body made up of state and local weights and measures officials from all parts of the United States, has a number of standing committees dealing with various phases of weights and measures activity. These committees are continuing to function during the period of recess of the national conference, and when matters arise upon which the national conference would ordinarily take action, such matters, if within the scope of one of these committees, are referred for committee consideration. The results of such committee actions are then made public as recommendations of the national conference, the *Weights and Measures News Letter* of the National Bureau of Standards being the medium for informing state and local weights and measures officials of these recommendations. The president of the national conference, Dr. Lyman J. Briggs, director of the National Bureau of Standards, and the secretary, R. W. Smith, assistant chief of the Division of Weights and Measures of the bureau, have been called upon by war agencies in Washington to present the recommendations of the national conference.

Meetings of state weights and measures associations have in a few instances been cancelled this year. However, most of the officials of the state associations of weights and measures, which have normally held meetings each year, have held regular meetings during 1942, in Connecticut, Minnesota, Indiana, Massachusetts, North Carolina, Pennsylvania, New Jersey, Texas and Virginia. Meetings scheduled for the remainder of 1942 include The California Weights and Measures Association, at Bakersfield, Calif., on October 21, 22 and 23, and the Ohio Weights and Measures Association at Columbus, Ohio, on December 1, 2 and 3.

THE INDUSTRIAL RESEARCH INSTITUTE

The Industrial Research Institute met in Buffalo, N. Y., on September 4 and 5, with headquarters at the Hotel Statler. Seventy-five industrial executives and research directors, representing member companies, and their guests participated in round-table discussions of current research management problems.

Patent trends and pending legislation were reviewed by H. S. Demaree, head of the Patent Department of the Hoover Company, Chicago, at the opening session on Friday morning. Following this, E. R. Schaeffer, chief of the Safety and Technical Equipment Branch, War Production Board, outlined the Production Requirements Plan and its effect on research laboratories. The mass spectrometer as a new research tool was described by Harold Washburn, of Consolidated Engineers, Pasadena.

The group spent Friday afternoon inspecting the new assembly plant of the Curtiss-Wright Corporation in Buffalo, and witnessed performance tests of the P-40 pursuit planes produced by this company. Frederic Flader, chief engineer of Curtiss-Wright, made an address at an informal dinner that evening on research and its trends in the aviation industry.

The principal speaker at the Saturday morning round-table session was C. E. K. Mees, vice-president and director of research of the Eastman Kodak Company, who outlined his philosophy of the direction of research based on thirty-five years' experience. Discussion of other current problems presented from the floor by members and a business meeting concluded the formal program. It is proposed to publish a monograph on the organization of industrial research laboratories. This will be based on member experience and should serve as a reliable reference work.

The institute, an affiliate of the National Research Council, undertakes to promote improvement of methods and more economical and effective management in industrial research through the cooperative efforts of its members. The membership is composed of forty-six industrial concerns maintaining research laboratories, represented by the executives in charge. The headquarters of the institute are at 60 East 42nd Street, New York, having been moved recently from Chicago.

Harvey S. Benson, administrative engineer, United Shoe Machinery Corporation, Beverly, Mass., is chairman of the executive committee. William R. Hainsworth, vice-president, Servel, Inc., New York, is vice-chairman. Other members of the committee are F. W. Blair, director of the Chemical Division, the Procter and Gamble Company, Ivorydale, Ohio; Caryl P. Haskins, president, Haskins Laboratories, New York; Maurice Holland, Division of Engineering and Industrial Research, National Research Council; R. C. Newton, vice-president, Swift and Company, Chicago; Philip W. Pillsbury, president, Pillsbury Flour Mills Company, Minneapolis; and Harold K. Work, manager of research and development, Jones and Laughlin Steel Corporation, Pittsburgh.

CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS

The 1942 Clinical Congress of the American College of Surgeons, originally scheduled for October at the Stevens Hotel, Chicago, which was taken over on August 1 by the U. S. Army Air Corps, will be held from November 17 to 20 in Cleveland, with headquarters at the Cleveland Public Auditorium, according to an announcement from the headquarters of the college in Chicago. The twenty-fifth annual Hospital Standardization Conference sponsored by the college will be held simultaneously.

The program of panel discussions, clinical conferences, scientific sessions, hospital meetings and medical motion picture exhibitions at headquarters, and operative clinics and demonstrations in the local hospitals and Western Reserve University School of Medicine has been centered around the many medical and surgical problems arising out of the prosecution of an all-out effort to win the war, emphasizing the needs of the rapidly expanding medical services of the Army and the Navy, and consideration of special problems related to the increasing activities for civilian defense.

The program of both meetings will begin with a joint general assembly on Tuesday morning, November 17, with addresses by Surgeon General James C. Magee, of the Medical Corps, U. S. Army; Surgeon General Ross T. McIntire, of the Medical Corps, U. S. Navy; Surgeon General Thomas Parran, of the U. S. Public Health Service; Lieutenant Colonel George Baehr, chief medical officer of the U. S. Office of Civilian Defense; Dr. Frank H. Lahey, chairman of the directing board of the Procurement and Assignment Service; Dr. Irvin Abell, chairman of the Board of

Regents of the college and chairman of the Health and Medical Committee of the Federal Security Agency, and Dr. W. Edward Gallie, of Toronto, president of the college. Surgeons General Magee and McIntire and Colonel Baehr will also speak at the presidential meeting and convocation on the same evening.

The Forum on Fundamental Surgical Problems inaugurated at the 1941 Clinical Congress will be repeated to give the younger men, representing various university departments of surgery, an opportunity to present the important results of their clinical and experimental research work before a large surgical meeting. Heretofore these younger men have seldom been able to present their original work and ideas, since many of them have not yet qualified for membership in the principal surgical societies. The forum will be held on three successive mornings.

The officers-elect of the college who will be inaugurated on November 17 are Dr. Irvin Abell, of Louisville, *President;* Dr. Leland S. McKittrick, of Boston, *First Vice-president,* and Dr. F. Phinizy Calhoun, of Atlanta, *Second Vice-president.*

A large technical exhibition, in which leading manufacturers of surgical instruments and supplies, sutures, dressings, pharmaceuticals, operating room equipment, x-ray apparatus and hospital equipment of all kinds, as well as publishers of medical books, will participate, will be as usual a feature of the congress. It will be housed in the exhibit hall of the Cleveland Public Auditorium.

THE GRADUATE FORTNIGHT OF THE NEW YORK ACADEMY OF MEDICINE

DR. MALCOLM GOODRIDGE, president of the New York Academy of Medicine, inaugurated the 1942 Graduate Fortnight, which opened on October 12, with an address of welcome. He drew attention to the fact that this year's Graduate Fortnight is the fifteenth in the series given annually. He paid tribute to the late Dr. Ludwig Kast, on whose recommendation and through whose generous support the institution was realized.

Beginning on October 12 and continuing through October 23, physicians from the metropolitan New York area and from many states in the Union met daily at the clinical conferences, pathological demonstrations, round-table discussions and evening sessions to study and review the best procedures for the diagnosis, treatment and prevention of the disorders of the nervous system likely to be experienced by the armed forces and by our industrial and civil population. The program covered not only those physical injuries which may result from violence and from infections, but also those of a purely psychological origin.

An exhibit embracing the most important phases of the problem, to which the leading medical institutions of the country contributed, was on view at the academy.

At the evening sessions twenty-two addresses were given on a variety of subjects ranging from the pathology of injuries to the head and other portions of the nervous system, to the critical evaluation of vitamin therapy in neurology. A hundred and twenty-one clinical sessions providing "bedside" and other conferences were held in eighteen hospitals of Greater New York. Panel discussions covered the subjects of Poliomyelitis, Psychoneuroses of War, the Vitamins in Disorders of the Nervous System and Psychotherapy. A demonstration of the Kenny method of treatment of poliomyelitis was given daily under the direction of Dr. D. W. Gudakunst, medical director of the National Foundation for Infantile Paralysis.

The Graduate Fortnight was organized by the Committee on Medical Education of the New York Academy of Medicine, of which Dr. Arthur F. Chace is chairman and Dr. Mahlon Ashford is secretary. Dr. Tracy J. Putnam was chairman of the committee in charge.

SCIENTIFIC NOTES AND NEWS

THE doctorate of laws was conferred by Ursinus College on Dr. William D. Coolidge, vice-president and director of research of the General Electric Company, at the dedication on October 13 of the Pfahler Hall of Science, which was erected at a cost of $750,000. A portrait of Dr. George E. Pfahler, known for his work on the use of x-rays and radium in medicine, for whom the building is named, was unveiled. Dr. Coolidge gave the Founders' Day address. He spoke on "The Role of Science Institutions in Our Civilization."

A DINNER in honor of Dr. Gustav Egloff is being given on October 23 by the New York Chapter of the American Institute of Chemists at the Chemists' Club, New York, under the presidency of the chairman, Dr. E. H. Northey. Speakers and their subjects include Dr. Robert J. Moore, "The Personal History of Egloff, the Author"; Colonel George A. Burrell, "Egloff, the Petroleum Expert"; and Dr. Marston T. Bogert, "The Influence of Egloff on the Progress of American Chemistry." The title of Dr. Egloff's address is "The Struggle for Oil and Its Products."

THE London correspondent of the *Journal* of the

American Medical Association reports that the following have been elected to the honorary fellowship of the Royal Society of Medicine: Great Britain, Lord Horder and Sir John Herbert Parsons, ophthalmologist, a former president of the society; from Canada, Professor W. E. Gallie, dean of the Medical Faculty of the University of Toronto, and Professor Jonathan Meakins, director of the Department of Medicine, McGill University; from Australia, Sir Charles Blackburn, consulting physician, Royal Prince Alfred Hospital, Sydney, and Sir Hugh Devine, lecturer in surgery, University of Melbourne. New Zealand is represented by Sir Henry Lindo, professor of ophthalmology and dean of the medical faculty, Otago University, and South Africa by Dr. A. W. Falconer, professor of medicine, University of Capetown. From the United States, Dr. Hugh Cabot, consulting surgeon of the Mayo Clinic; Dr. David Cheever, associate professor of surgical anatomy, Harvard Medical School (who had charge of the Harvard Surgical Unit in the last war), and Dr. W. T. Longcope, physician-in-chief of the Johns Hopkins Hospital.

SIR WILLIAM J. COLLINS, chairman of the Chadwick Trustees, presided on the occasion of the delivery on October 6 of the first lecture in the autumn program of the thirtieth annual series of the Chadwick Public Lectures of the Royal Society of Tropical Medicine. He presented the Chadwick Medal and Prize to Wilfred Glyndon May, of University College, London. Sir Leonard Hill made the address which was entitled "The Inter-relation of Clothing and Shortage of Fuel in Matters of Health."

SIR D'ARCY WENTWORTH THOMPSON, professor of natural history in the University of St. Andrews, will succeed the Earl of Rosebery as president of the Royal Scottish Geographical Society.

DR. ARTHUR I. KENDALL, research professor of bacteriology at the Medical School of Northwestern University, having reached the age of sixty-five years, retired on September 1.

DR. MARION WINIFRED HOOD, formerly of the College of Medicine of the University of Illinois, has been appointed assistant professor of parasitology in the Department of Public Health of the Louisiana State University School of Medicine.

DR. HENRY P. THIELMAN, of the College of St. Thomas, St. Paul, has been appointed assistant professor of mathematics at Iowa State College.

E. H. PETERSON, formerly of the University of Wisconsin, has joined the staff of the department of animal pathology at the Illinois College of Agriculture.

CHARLES G. MAIER, research metallurgist for nearly twenty years associated with the U. S. Bureau of Mines, has become a member of the supervisory staff of Battelle Memorial Institute, Columbus. He will direct and correlate an enlarged program of fundamental research and will serve as adviser and consultant to the war research for the Government and for industry conducted by the institute.

THE *Journal* of the American Medical Association states that Dr. Hermina H. Hartig has been appointed acting director of hygiene and health education of Minneapolis. Dr. Arthur E. Karlstrom, who has been director since 1940, has resigned to devote his entire time to private practice.

DR. JOHN L. LAVAN, health commissioner of Toledo and director of the health service in Toledo schools, has resigned to become director of scientific research for the National Foundation of Infantile Paralysis, New York.

JOHN C. MCGREGOR, curator of archeology and dendrochronology at the Museum of Northern Arizona at Flagstaff, has been appointed acting chief of the Illinois State Museum to take charge of the work of Major Thorne Deuel, who has leave of absence to serve with the U. S. Air Force.

PROFESSOR GEORGE W. SWANSON, head of the department of electrical engineering at the Michigan College of Mining and Technology, has been granted leave of absence to serve as a special consultant and operational analyst for the Army Air Corps. During his absence, Associate Professor Chester Russell will act as head of the department, and Nicholas Kaiser, Jr., will direct the war-training program.

DR. STANLEY B. FREEBORN, assistant dean of the College of Agriculture of the University of California and assistant director of the Experiment Station, has joined the Army. He is in charge of malaria research on the Pacific coast.

DR. SHEFFIELD A. NEAVE, assistant director of the Imperial Institute of Entomology, London, was elected on September 16 honorary secretary of the Zoological Society of London to fill the vacancy caused by the resignation of Dr. Julian Huxley. Dr. Neave will hold the office until April, 1943, when the next annual meeting will be held.

DR. VINCENT DU VIGNEAUD, professor of biochemistry, Cornell University Medical College, will deliver the first Harvey Society lecture of the current series at the New York Academy of Medicine on October 29. He will speak on "The Significance of Labile Methyl Groups in the Diet and Their Relation to Transmethylation."

THE 1942–43 Vanuxem Lectures of Princeton University will be given on December 1, 2, 8 and 9 by Dr. W. M. Stanley, of the Rockefeller Institute for Medical Research at Princeton, N. J., on "The Chemical and Biological Aspects of Viruses."

DR. STUART MUDD, professor of bacteriology at the School of Medicine of the University of Pennsylvania, gave on October 15 an address at a joint meeting of the Washington Academy of Sciences and the Washington Branch of the Society of American Bacteriologists. He spoke on "Structural Differentiation within the Bacterial Cell as Shown by the Electron Microscope."

DR. EMILIO MIRA, professor of psychiatry at the University of Buenos Aires, formerly professor of psychiatry at the University of Barcelona, has been appointed Salmon Lecturer for 1942 by the Salmon Committee on Psychiatry and Mental Hygiene of the New York Academy of Medicine. The lectures will be given on three successive Friday evenings, November 6, 13 and 20, in the building of the New York Academy of Medicine. The subject of the lectures will be "Psychiatry at War."

IN SCIENCE for October 9 it was stated erroneously that the Remington Medal is an award of the Philadelphia College of Pharmacy. The medal is awarded by the New York Branch of the American Pharmaceutical Association.

PROFESSOR H. R. ALDRICH, secretary of the Geological Society of America, announces that following a complete understanding and agreement with the Geological Survey of Canada the 1942 annual meeting scheduled to be held at Ottawa has been cancelled. The regular annual meeting of the society will be held on December 29 at the headquarters of the society. From a desire to cooperate with the Federal Government in reducing civilian travel and to encourage full concentration on the war effort, the meeting will be limited to the usual business sessions. Meetings of the council will be held as usual immediately before and after the annual meeting. Abstracts of the year will be printed as usual in the December *Bulletin*, and forms may be had on application to the secretary. Fellows who offered papers for oral presentation at Ottawa are reminded that plans for the New York meeting of the American Association for the Advancement of Science are proceeding and that it will be possible to present papers before Section E. Transfers of titles will be made to that program only on direct instructions from the authors.

DR. RUDOLF BENNITT, professor of zoology at the University of Missouri, announces that, by a three-to-one vote of organizations and individuals participating in earlier meetings of the Midwest Wildlife Conference, it has been decided owing to war conditions to postpone further meetings for the present. The conference has been held annually since 1935, and was to have been held in Missouri in December, 1942. The region embraced includes the north-central states of Missouri, Iowa, Minnesota, Wisconsin, Illinois, Indiana, Michigan and Ohio, though many representatives of bordering states attend each year. Missouri has been charged with the responsibility of reconvening the conference. The two host-organizations will be the Missouri Conservation Commission and the University of Missouri, the location of the Cooperative Wildlife Research Unit.

THE Illinois State Museum was host to the annual meeting of the Midwest Museums Conference held in Springfield on October 15, 16 and 17. New exhibits included the diorama hall with the Frost Illinois series of historical dioramas.

THE *Journal* of the American Medical Association reports that a conference was recently held with Dr. Bernardo A. Houssay as chairman for the appointment of an executive committee of the third Pan American Congress of Endocrinology, which will be held in Buenos Aires in July, 1943. The official topics will be (1) endocrine factors of diabetes, (2) gonadotropins and (3) the adrenal cortex. There will also be several lectures on endocrinology. The official headquarters of the executive committee of the congress is the Instituto de Fisiología de la Facultad de Ciencias Médicas of Buenos Aires, Calle Córdoba 2122. Letters requesting information should be sent to the secretary of the congress, Dr. Eduardo Braun Menéndez, at that address.

ON nomination by the council of the New York Academy of Medicine and by vote of its fellowship, fifty-seven physicians in South America have been elected corresponding fellows of the academy. Previously, but four South American physicians had been elected corresponding fellows. They were Dr. Angel Aballi, professor of pediatrics, University of Havana; Dr. Mariano R. Castex, professor of clinical medicine, Buenos Aires; Dr. Lucas Sierra, professor of clinical surgery, Santiago, and Dr. Luthero Vargas, chief orthopedic surgeon, Centro Medico Pedagogico, Oswaldo Cruz, Rio de Janeiro. The newly elected members are citizens of the following countries: Argentina, Colombia, Ecuador, Guatemala, Nicaragua, Peru, Brazil, Bolivia, Costa Rica, El Salvador, Honduras, Panama, Puerto Rico, Venezuela, Chile, Dominican Republic, Mexico, Paraguay, Uruguay and Cuba.

NOMINATIONS are requested for the 1943 award of $1,000 established by Mead Johnson and Company to promote research dealing with the B complex vitamins. The recipient of this award will be chosen by

a committee of judges of the American Institute of Nutrition, and the formal presentation will be made at the Cleveland meeting on April 7. The award will be given to the laboratory or clinical research worker in the United States or Canada who, in the opinion of the judges, has published during the previous calendar year January 1 to December 31 the most meritorious scientific report dealing with the field of the B complex vitamins. Further information can be obtained from Dr. Arthur H. Smith, of the College of Medicine of Wayne University, Detroit, who is secretary of the American Institute of Nutrition.

DISCUSSION

THE BACTERIAL OXIDATION OF RUBBER[1]

In studying the biological oxygen demand of sea water[2] it has been observed that rubber stoppers increase the amount of oxygen consumed. In fact, the small amount of rubber gasket exposed to the water in citrate of magnesia bottles perceptibly increases the amount of oxygen consumed after 5 to 10 days incubation. Heat-sterilized, as well as formaldehyde-preserved, controls prove that the increased oxygen consumption is attributable to biological activity.

One-gram quantities of various kinds of rubber cut in small pieces to give a surface area of approximately 10 sq. cm were placed in 160 ml glass-stoppered bottles. After sterilizing in the autoclave at 120° C. for 20 minutes the bottles were filled with sterile water saturated with oxygen. Half of the bottles were inoculated and the others remained sterile. Duplicate bottles were analyzed for oxygen immediately using the Winkler technique, and the others were incubated in the water bath for one to five days at 22° C. after which the amount of oxygen consumed was determined. It is necessary to decant or siphon the water from the rubber before treating it with the Winkler reagents because free iodine reacts with rubber.

Using samples of rubber stoppers, rubber tubing, pure gum rubber, duprene and neoprene it was found that whereas 0.53 to 0.88 mgm/l of oxygen was consumed in the sterile controls after 5 days incubation, 5.11 to 6.74 mgm/l of oxygen was consumed in the inoculated water. Similar results were obtained when the controls were preserved with 1.0 per cent. formaldehyde. That the increased oxygen consumption is caused by microorganisms is indicated by the fact that the rate of oxygen consumption increases exponentially with time typical of a growth-curve and, more convincingly, by the multiplication of microorganisms.

Realizing that most of the aforementioned rubber products contain sulphur and other oxidizable constituents used as fillers or impurities, the experiments were repeated with several samples of highly purified (non-vulcanized) caoutchouc or latex obtained from the Goodyear Tire and Rubber Company. Small quantities dissolved in C.P. benzene were distributed in bottles which were manipulated to form a thin film of the purified rubber on the inside of the bottles as the benzene evaporated. After driving off all the benzene the bottles were filled with oxygenated water. Following the incubation of inoculated water it was found that 2 to 2.5 mgm of oxygen was consumed in the presence of 1 mgm of purified rubber. This together with the production of carbon dioxide which was estimated manometrically indicated that most of the rubber was oxidized. Considering rubber to be $(C_5H_8)_x$, it would require about 3.3 mgm of oxygen to completely oxidize 1 mgm of rubber. Part of the rubber was converted into bacterial protoplasm as shown by the number of bacteria which appeared. The perforation of thin films of rubber on agar and on glass slides immersed in culture solutions gives further proof that rubber is utilized by microorganisms.

Confirming the observations of Söhngen and Fol[3] and Spence and van Niel[4] most of the rubber oxidizing microorganisms which have been observed belong to the genus *Actinomyces* or *Proactinomyces*. Many of the latter utilize complex hydrocarbons according to Umbreit.[5] Rubber oxidizing *Mycobacterium* and *Pseudomonas* have also been isolated from our enrichment cultures. The aerial mycelium of an unidentified mold virtually enveloped the moist rubber on which it was growing and its substrate mycelium seemed to penetrate the rubber.

Using oxygen consumption with adequate controls as a criterion of their presence, rubber oxidizing bacteria have been found to be quite widely distributed in the sea and in garden soil. Neither in nature nor in the laboratory do the rubber oxidizing microorganisms appear to require rubber or related hydrocarbons for their multiplicaion but old pieces of rubber hose and the cracks in tires found in moist places have proved to be good sources of cultures.

Besides showing that neither synthetic nor pure India rubber is biologically inert and proving that rubber oxidizing microorganisms occur fairly abundantly in nature, the observations suggest that such

[1] Contribution from the Scripps Institution of Oceanography, New Series No. 179.

[2] C. E. ZoBell, *Jour. Mar. Res.*, 3: 211, 1940.

[3] N. L. Söhngen and J. G. Fol, *Centralbl. f. Bakt.*, II. Abt., 40: 87, 1914.

[4] D. Spence and C. B. van Niel, *Ind. and Eng. Chem.*, 28: 849, 1936.

[5] W. W. Umbreit, *Jour. Bact.*, 38: 73, 1939.

microorganisms may play an important role in the deterioration of rubber products. The life of rubber products which come in contact with moisture may be prolonged if ways can be found to retard or prevent the activity of rubber oxidizing microorganisms.

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STATE BOARD STATISTICS AS A BASIS FOR COMPARISON OF MEDICAL SCHOOLS

A RECENT article in SCIENCE,[1] by Albert E. Casey, compares 15 medical schools with respect to quality of teaching. A *definite rank in the group* is assigned to each school. Several features of the article appear to deserve comment.

(1) The state board statistics, cited as a basis for the comparison, do not agree with the annual tabulations of such data published in the *Journal* of the American Medical Association.[2] Three of the discrepancies concern the number of graduates listed from individual schools and are too small to be important. But Dr. Casey attributes to Loyola 53 failures, on foreign state board examinations, during the five-year period covered by his study. The annual tabulations in the *Journal* of the American Medical Association list only 32 such failures for Loyola. We have examined each individual state board report, published and indexed in that journal, for the years in question; but have not been able to confirm Dr. Casey's figure.

(2) Any comparison of schools from state board statistics is complicated by two facts. They are (a) *that the geographical distribution of graduates is* not the same for any two schools, and (b) that the rate of failure, for all candidates examined, is consistently higher *in some* states than in others. Dr. Casey does not indicate the distribution of candidates or of failures by states. According to the annual tabulations in the *Journal* of the American Medical Association,[2] more than half of all the failures listed by Dr. Casey occurred in two states, New York and Massachusetts. Each of the 15 schools had a higher rate of failure in those two states (taken together) than elsewhere, and for the entire group of schools there were 202 failures out of 986 examinations (20.5 per cent.). In all other states combined (excluding, as Dr. Casey does, candidates locally graduated) there were 154 failures out of 3,974 examinations (3.9 per cent.). The several schools were not represented in New York and Massachusetts by equal quotas of graduates. One school had 5.5 per cent. of its listed graduates examined in those two states, another 35.3 per cent. Quotas for the remaining schools varied between these extremes. For the five schools highest on Dr. Casey's list the average quota was 12.3 per cent.; for the five lowest, 25.6 per cent.

Now the reason for the disparity of failure rates, from state to state, is a matter of opinion. We may assume that examination standards are everywhere uniform; but this logically implies that the weakest graduates from all schools show a conspicuous preference for certain states, a phenomenon which might be difficult to account for. If we assume, alternatively, that examination standards vary from state to state, then obviously the number of failures charged to a given school must be determined largely by the geographical distribution of its graduates. It thus becomes somewhat difficult to compare any two schools, and considerably more so to compare fifteen. Dr. Casey ingeniously avoids these complications by using *both assumptions at the same time*. He excludes all examinations taken by candidates in the states where they were graduated, and calculates from *the remaining data the percentage of failures for each* school. If examination standards are uniform, there is no reason to exclude local examinations; if they are not uniform, failure percentages calculated from the remaining data are not fairly comparable.

(3) If all candidates were examined by the same board, variations of failure rate from school to school would no doubt appear. It does not follow, however, that such differences would be due entirely to variations in the quality of teaching, unless it can be shown that the schools are on an equal basis with respect to the quality of classes entering. The applicants annually accepted by the medical schools of the country are, in the judgment of admitting officials, the best available; but Dr. Casey offers no proof that the class entering at Harvard, for example (the first school on his list), is a representative cross-section of the larger group of students admitted to all the schools.

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WHAT PRICE GLORY?

IN a recent issue of the *Journal* of the American Medical Association (July 25, 1942, page 1041), Dr. Rendich, of Brooklyn, has stated that the more prominent physicians—those whose death notices head the weekly list in the *Journal*—die on the average 4.7 years earlier in life than do those whose demise receives only a bare mention. This rather markedly shortened life span he infers to be the price of success or prominence in the medical world.

[6] On sabbatical leave from Brooklyn College, New York. Assisted by grant No. 555 from the American Philosophical Society.

[1] Albert E. Casey, SCIENCE, 96: 110, 1942.

[2] *Journal of the American Medical Association*, 98: 1458, 1932; 100: 1240, 1933; 104: 1506, 1935; 106: 1476, 1936; and 108: 1412, 1937.

Rendich's logic may point in the right direction, since the stress of successful activity could well accentuate the physicians' already strong tendency to die of degenerative disease; his facts, however, are inadequate to establish the point. A more complete investigation of the subject brings out some rather striking information.

In Table 1 are given the mean ages at death of physicians awarded, respectively, 2, 3–5, 6–10, 11–15, 16–20 and 21 or more lines in the "Death Notices" columns of the *Journal*. Two hundred cases in each group were considered adequate to give a stable mean, but this number could not be obtained for the two upper classes without going back more than five years; use of older death lists was considered inadvisable because of sharp changes in certain disease mortalities—such, for instance, as has followed introduction of the newer forms of chemotherapy.

TABLE 1

Death Age of Physicians According to Degree of Prominence

Number of lines in death column notices	Number of cases	Mean age at death years
2	200	71.2750 ± 0.5134
3– 5	200	67.1750 ± 0.5875
6–10	200	65.2250 ± 0.5384
11–15	200	65.9250 ± 0.5096
16–20	100	68.0000 ± 0.6643
21+	136	70.5885 ± 0.5520

Here is evident a very definite and statistically significant trend in death age according to degree of prominence attained. Those whose deaths received bare mention lived to the greatest age but were closely followed by those whose achievements gained wide attention. Those achieving only mediocre success seemed to pay the highest price in terms of an earlier death age. The difference between the mean death ages of those with 2 lines and those with 6–10 lines is 6.0500 ± 0.7439 years; this difference is 8.1 times its own probable error and would almost never occur by chance alone (only once in 100,000,000 times, more or less). Likewise, the difference in death age between those with 6–10 lines and those with 21+ lines (5.3635 ± 0.7711 years) is 7 times its own probable error and would occur by chance only once in about 500,000 times. The differences between the 6–10 and the 11–15 line groups and between the 2 and the 21+ line groups are only of the same order as their own probable errors and hence are without significance.

Interesting speculation may well be given to these observed differences in the mean life span. Do the really great live longer and achieve more because of a greater vitality and working capacity, or do they reach a higher plane of success as a result of their added years of effort? Since most great physicians have already made a name for themselves in the medical world by the time they are 50 years old, it seems likely that a high vitality of brain and body is the responsible factor. At any rate, the great seem not so inclined to die young or break down in the struggle as are the somewhat less successful; instead, their heritage appears more likely to be a ripe old age. This is indeed fortunate for society, for their great intrinsic capability is thus seasoned by a longer lifetime of experience and observation; these are the men whose counsel becomes increasingly valuable with advancing age.

Clarence A. Mills

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CORRECTION

The 1942 U.S.D.A. Yearbook, "Keeping Livestock Healthy," page 1096, fails to give proper credit to the research workers responsible for the experimental production of goiter in poultry. This was first accomplished in 1938 by A. R. Patton, H. S. Wilgus, Jr., and G. S. Harshfield (Science, 89: 162, 1939).

A. R. Patton

Montana State College

SPECIAL CORRESPONDENCE

THE ETHNOGEOGRAPHIC BOARD

As a means of integrating certain types of federal and non-federal research, there has been established in Washington an Ethnogeographic Board under the joint sponsorship of the American Council of Learned Societies, the Social Science Research Council, the National Research Council and the Smithsonian Institution.

The Ethnogeographic Board is an extra-governmental agency concerned with war and post-war problems in the field of ethnogeography, the study of human and natural resources of world areas, particularly with communities and cultural regions outside the continental United States. Its function is that of a useful clearing house between the sponsoring institutions, with their numerous affiliated scientific and educational organizations outside of Washington and the war agencies within the Government. The board functions in cooperation with the Joint Committee on Latin American Studies of the "three Councils"; the Smithsonian War Committee, the Intensive Language Program of the American Council of Learned Societies, the Committees on the Anthropology of

Oceania and Africa of the National Research Council and related organizations.

The offices of the board are in the Smithsonian Institution Building, Tenth and Independence Avenue, S.W., Washington, D. C. (Telephones: District 1667; National 1810, extension 7).

The purposes of the Ethnogeographic Board are twofold: first, and most immediate, through the office of its director, to make readily accessible to Washington military and war agencies such specific regional information and evaluated personnel data as is available to the sponsoring institutions and numerous other governmental and outside scientific organizations with which they are affiliated or in contact; and second, with an eye to future needs, to encourage the promulgation through these institutions and outside agencies of more extensive research projects along the lines of applicable social science, linguistics and human geography. The Ethnogeographic Board, because of its regional approach to human problems in the geographic, biological and social sciences, is interdisciplinary in scope. Because of its close association with the four sponsoring organizations and, through them, with their affiliated scientific and professional societies and the universities, it possesses unusual facilities for locating the most competent authorities upon specific subjects, and for recommending the inauguration by research organizations outside of the government of broader studies, which have a direct bearing upon governmental war and post-war needs.

Since the opening of its offices in June, the Ethnogeographic Board has made progress toward accomplishing these purposes. Personnel lists of world areas of strategic importance have been placed in the hands of offices and individuals charged with the prosecution of the war. Information of interest to these offices has been secured from competent individuals and placed in the official channels of greatest usefulness. Moreover, many scientists, professional men and world travelers visiting Washington have made it a practice to see that the board is in possession of data regarding their field experience and special capabilities. Others who know that their names do not appear in any of the available lists are encouraged to correspond with the director.

In response to other requests from the military agencies, the Ethnogeographic Board has arranged for special research projects by university departments in the fields of human biology, culture and geography. The further cooperation of universiites, scientific and professional societies, committees and university departments in these fields is requested. The board offers special facilities for the prompt transmission of useful information and research potentialities to the military, war agencies and other departments of the government which are directly concerned with the vast social, economic and political changes now in accelerated progress in all parts of the world.

The membership of the board, which serves as a policy-forming and advisory body to the director, was chosen jointly by the four sponsoring institutions. The members were designated as representatives of varied important human disciplines, on the basis of their familiarity with one or more geographical regions and their experience and associations. In addition, the executive officers of the sponsoring institutions act as advisers to the director in Washington. Other individuals in close contact with the work of the board may be elected consultants. As the need arises additional members of the Ethnogeographic Board may be appointed. The present members are Carl E. Guthe, *Chairman*, University of Michigan; Wendell C. Bennett, Yale University; Carter Goodrich, Columbia University; John E. Graf, U. S. National Museum; Robert B. Hall, University of Michigan, and Wilbur A. Sawyer, Rockefeller Foundation.

WILLIAM DUNCAN STRONG

ETHNOGEOGRAPHIC BOARD

LOCATION OF NEW AND RARE INSTRUMENTS

THE Committee on Location of New and Rare Instruments has the following offers and requests:

Instruments Offered

Curie Electrometer (Paris make)
Loewe-Zeiss Liquid Interferometer
L. & N. Portable Potentiometer (No. 7655) with 2 quinhydrone and 1 calomel electrodes
Microammeter, D'Arsonval Type (Model S of Sensitive Research Instrument Corp.). Rental only
Quartz Microscope
Siemens & Halske Optical Pyrometer
Two-circle Reflecting Goniometer (several).
Welch D.C. Volt-Ammeter (0–150v. 0–15a.)
Westinghouse 4-unit moving coil Type PA Oscillograph with three galvanometers
Weston Galvanometer (#375)
Weston Galvanometer (#440)
Weston Voltmeter (#280)

Instruments Needed

Coleman Spectrophotometer (10 requests)
Grating Spectrograph (9 requests)
Leitz Ultrapak or equivalent
Quartz Spectrograph
Zeiss Optimeter
Zeiss Pulfrich Refractometer (8 requests).

Information concerning these offers and requests for rare instruments that can be sold, loaned or leased for essential war or other research can be obtained from the undersigned.

D. H. KILLEFFER,
Chairman of the Committee

60 EAST 42D ST.,
NEW YORK, N. Y.

SCIENTIFIC BOOKS

ELECTRIC WAVES

Fundamentals of Electric Waves. By HUGH HILDRETH SKILLING. 186 pages, 65 illustrations. John Wiley and Sons, Inc. $2.75.

THE ever-increasing importance of ultra-high frequency in modern communication practice acutely emphasizes the need for an approach to the electromagnetic problems involved other than that of the conventional circuit theory, so familiar to engineers. Instead, for most problems it is essential to adopt the point of view of the electromagnetic field. Since the latter approach is not so familiar to engineering students, Professor Skilling's book performs a very useful function and fills a long-felt need. The particular advantage of this book is the fact that it has been designed with the practical applications in view. Thus while the material is reasonably complete the discussion in general is as brief as is consistent with clarity. The book is, however, to be regarded only as an introduction, providing the reader with a sufficient knowledge of the subject to cope with the more involved treatises in which special problems are treated in greater detail.

The scope of this book can best be appreciated from a brief discussion of the contents. The first half of the book is concerned with the general nature of electric and magnetic fields, the study of the static fields being basic to this development. The experimental basis of the laws of electricity and magnetism are put in evidence so that the reader at once recognizes the fundamental definitions and relations on which the theory rests. At the same time an attempt is made to render familiar, by means of schematic models, the essential mathematical constructs (vector operators). The latter half of the book is devoted to a discussion of the Maxwell equations and the propagation of electromagnetic waves. The applications (antennas and wave guides) are confined to the last two chapters.

The author is to be commended for the illustrations, which are well chosen. The collection of tables on the inside covers of the book (conversion factors for the various systems of units, formulas and the fundamental field equations) should be very useful. In addition the illustrative problems given at the end of each chapter and the examples interspersed in the text serve to provide practice in the application of the principles discussed.

While an admirable attempt is made to stress the physical meaning of the various concepts introduced it seems regrettable that this is often done at the expense of rigor. For example, the integral solution of the Poisson equation in electrostatics is presented as a self-evident generalization of the field of discrete point charges. This lack of rigor in itself would not constitute a serious objection, in so far as it does not directly interfere with what may be considered the primary purpose of the book; *viz.*, to provide the reader with a working knowledge of the field theory of electromagnetic waves. However, it seems worthy of note inasmuch as a claim of rigor is made.

M. E. ROSE

ORGANIC CHEMISTRY

Modern Theories of Organic Chemistry. By H. B. WATSON. Second edition. Pp. vii + 267. Oxford: Clarendon Press. April, 1941. $5.00.

THE first edition of this excellent treatise appeared in November, 1937, and was reprinted in 1940. That edition has now been thoroughly revised, various alterations and rearrangements have been made in the interest of clarity and serviceability, and the treatment of some topics has been considerably expanded, while the general purpose, plan and scope of the book remain much the same, the main theme being the application of the electronic theory to the reactions of organic compounds.

The subject-matter is presented under the following chapter headings: I. Theories of Chemical Combination; II. Applications of the Electronic Theory in Organic Chemistry. Strengths of Acids and Bases. The Inductive Effect; III. Applications of the Electronic Theory in Organic Chemistry. Substitution in Aromatic Compounds; IV. The New Physical Methods of Investigation; V. Kinetic Methods; VI. Applications of the Electronic Theory in Organic Chemistry. General Discussion; VII. Free Radicals; VIII. Compounds of Divalent Carbon and Allied Problems; IX. Esterification and Hydrolysis; X. Aliphatic Substitution; XI. Addition to Unsaturated Compounds; XII. Tautomeric Change; XIII. Migrations from Side-chain to Nucleus and Other Rearrangements; XIV. A Review of Some Stereochemical Problems; XV. Applications of Kinetic Methods to Stereochemical Problems; XVI. Stereochemistry of Elements Other Than Carbon.

As explained by the author in the first edition, his object has been to give a bird's-eye view over the field rather than minute details of more limited areas. Hence it is not, nor pretends to be, encyclopedic in character, but is a clear and compact presentation of those topics with which it deals, and as such is cordially recommended to all interested in organic chemistry. Paper, binding and press work are excellent.

MARSTON TAYLOR BOGERT

SOCIETIES AND MEETINGS

THE AMERICAN MATHEMATICAL SOCIETY

THE forty-eighth summer meeting of the American Mathematical Society was held at Vassar College, from September 8 to 10, in conjunction with meetings of the Mathematical Association of America and the Institute of Mathematical Statistics. The attendance was about three hundred, including a hundred ninety-seven members of the society.

The Colloquium on "Topology of Manifolds" consisted of four lectures of one hour each delivered by Professor R. L. Wilder, of the University of Michigan. An invited address on "Transformations with Periodic Properties" was given by Professor W. L. Ayres, of Purdue University. A symposium on "The Applicability of Mathematical Statistics to the War Effort" was held jointly with the Institute of Mathematical Statistics. This symposium consisted of two addresses, "Statistical Prediction with Special Reference to the Problem of Tolerance Limits," by Professor S. S. Wilks, of Princeton University, and "On the Nature of Mathematical Statistics in Quality Control," by Dr. W. E. Deming, of the U. S. Department of Commerce, together with discussions by Professor J. H. Curtiss, of Cornell University, and Dean Walter Bartky, of the University of Chicago. Eighty-nine papers on current research were presented, 34 in person and 55 by title. Nine of those presented in person at a joint session of the society and the institute dealt with problems of mathematical statistics.

The buildings and facilities of Vassar College were made available to members and their guests.

T. R. HOLLCROFT,
Associate Secretary

THE ARKANSAS ACADEMY OF SCIENCE

THE twenty-sixth annual meeting of the Arkansas Academy of Science was held at State A. and M. College, Monticello, on Friday and Saturday, May 1 and 2.

Papers were grouped in two sections, namely, a physical science and a biological science section but read in a joint session. The evening session was devoted to a round-table discussion on science teaching.

Owing to transportation difficulties and other war-connected difficulties, the far eastern state trip proved to be somewhat of a handicap for normal attendance. About thirty-five heard a total of sixteen papers. Mr. R. J. Anderson, acting state geologist, who discussed "Strategic Mineral Resources of Arkansas," provided the special feature of the program. The factory trips scheduled for Saturday morning had to be abandoned, because of war-time restrictions on visits to factories working on war contracts.

The academy published its first volume of "Proceedings of the Arkansas Academy of Science" in May of this year. This volume contains an early history of the academy, a copy of the constitution and by-laws, past officers and members, as well as papers presented at the twenty-fifth annual meeting of the academy held in 1941 at Henderson State Teachers College.

Officers elected for 1943 are as follows:

President, L. B. Roberts, Monticello; *Vice-president,* C. E. Abbott, Searcy; *Secretary,* L. B. Ham, Fayetteville; *Treasurer,* T. L. Smith, Clarksville; *Editor,* D. M. Moore, Fayetteville. This is the fifth of a five-year term for the secretary.

L. B. HAM,
Secretary

SPECIAL ARTICLES

VITAMIN C IN THE WAR

WE know that Germany has, for a few years, been using vitamins for special fighting forces. Great Britain, too, has been alert to the value of vitamins A, B_1 and C as aids to the war effort. We must do more than supply our own armed forces with a vitamin-rich diet. Under certain severe conditions soldiers may need dietary supplements of certain vitamins.

This is especially true of vitamin C, ascorbic acid, of which the United States used 17 tons in 1940 and may soon reach an annual output (synthetic) of 100 tons. However, our allies are getting much of this.

LOSS IN PERSPIRATION

Vitamin C is destroyed by infection and by a number of industrial poisons of a military nature. It is also lost in appreciable quantities in heavy perspiration.[1] One important industrial organization, observing many heat prostrations under very hot working conditions, adopted the practice of giving each worker daily a tablet containing vitamins C and B_1 and common salt (all lost to some extent in perspiration). Improvement in general vigor was most encouraging —and there were no more heat prostrations. Similar conditions often exist in war areas in the tropics and in North Africa. The function of the vitamin C may go beyond mere replacement of the amount lost. It may combat heat shock.

SHOCK

Shock results from a number of causes, so vitamin C therapy ought to be considered in all such cases.

[1] R. E. Bernstein, *Nature*, 140: 684, 1937.

Dr. Georges Ungar, of the Free French Forces, now at Oxford University, found that guinea pigs injured to an extent that otherwise would have caused 100 per cent. mortality survived when given considerable vitamin C immediately after injury (subcutaneous injection). Delay of one hour reduced recovery to 50 per cent.

The question naturally arises whether shock of various types in man, surgical, for example, may not be lessened by adequate administration of this vitamin. Private reports from a group of physicians and chemists in a certain large city show that in numerous instances intravenous injection of a sterile solution (20 cc) containing one gram of vitamin C, partly buffered, produced astonishing recovery from severe postoperative shock. This treatment is being tried in a few medical centers and might well be tested by surgeons in our armed forces. Numerous investigators have reported a decrease in the ascorbic acid concentration of the blood plasma following operations.

Allergic Shock

Allergic shock, perhaps through the histamine mechanism, lowers the vitamin C level of the body. In a study of hay fever by Holmes and Alexander, just completed at Oberlin, it was observed that a high percentage of sufferers showed a very low urinary excretion of vitamin C. Administration of 200 or 500 mg daily caused decided improvement, or even remarkable gains, in all but three of the twenty-five patients. Soldiers are not immune to hay fever, in season, and might profit from this research on effective dosage.

Wound Healing

Rapid healing of wounds is a matter of military concern, so it might well be noted that vitamin C plays an important role in healing of fractures[2] and of wounds in general. The health of intercellular tissue depends, in part, upon an adequate level of this vitamin.

Medicines must be given the armed forces. If occasional syphilis is to be treated with arsenicals[3, 4] some of the uncomfortable results are diminished by an adequate preliminary dose of vitamin C.

Benzene and Toluene Poisoning

Benzene and tolune are industrial solvents of importance to war industries as well as basic materials for manufacture of T.N.T. and other explosives. They are somewhat toxic in liquid or vapor form. Joseph Hagen,[5] after studying the blood and urine of animals poisoned with benzene, was convinced that benzene destroys vitamin C. He extended these studies to printers exposed to benzene in their work. His conclusion was that "a detoxication as well as a repairing action of the poisoned blood formation centers may well be attributed to vitamin C administred in the case of chronic benzene poisoning."

One of the large rubber companies cooperated with me by giving 100 mg of vitamin C daily to 100 workmen exposed to a "safe" concentration of benzene and toluene vapors in the factory air. After a short time 37 of the workmen reported feeling "less tired" at the end of the day. Ten felt in better health generally and only 31 reported no gain. The management extended the experiments and will report later. A firm in Canada is also cooperating in a study of these toxic substances.

T.N.T. Poisoning

A confidential report from a T.N.T. plant in Britain strongly endorses the vitamin C treatment of workers. Details of diagnosis of T.N.T. poisoning are included but can not be given here. The physician in charge firmly believes from tests that T.N.T. destroys vitamin C. As treatment the poisoned workers were given 100 mg daily of vitamin C (ascorbic acid), "each dose being followed by one drachm of bicarbonate of soda in solution." Of course, the soda reduced any irritation caused by the ascorbic acid.

To quote the physician, "The results indicate that vitamin C therapy is very effective in the treatment of T.N.T. poisoning cases. Excluding one fatal case (proved to be impossible of treatment), I have treated successfully 57 cases of severe poisoning. The response to treatment was rapid."

In cooperation with an important powder company in the United States I strongly recommended giving every workman handling T.N.T. a daily dose of 100 mg of vitamin C. This is now their practice, although I have no report of the results. In a number of T.N.T. plants this preventative measure is being taken.

A chemist employed during 1940 in a T.N.T. plant in Central Europe reported privately to me that the company physician noticed poorer health in the workmen during the winter season when these peasants had no fresh fruits and vegetables, rich in vitamin C. At company expense each worker was given two oranges daily, with excellent improvement in health and vigor.

Poisoning due to tetryl (booster charge in shells) is now occasioning medical concern. If it has not already been done, we should determine the vitamin C

[2] J. Hertz, *Brit. Med. Jour.*, 2: 980, 1936.
[3] Mahlon Delp, *Jour. Kans. Med. Soc.*, December, 1941.
[4] A. D. Vail, *Jour. Mo. Med. Asn.*, 38: 110, 1941.
[5] Joseph Hagen, *Archiv. für Gewerbepathologie und Gewerbehygiene*, 9: 698, 1939.

level in the bodies of workers exposed to tetryl and if it appears to be lowered start daily administration of 100 or 200 mg. No harm will be done.

LEAD AND ZINC POISONING

In 1939 Holmes and Campbell[6] reported that dust of lead or its compounds destroyed some vitamin C in the bodies of workers exposed to the toxic dust. Daily doses of 200 mg of this vitamin in most cases resulted in great improvement in health. These findings have been confirmed by Marchmont-Robinson.[7]

The zinc oxide fume given off when brass is melted is causing symptoms that are somewhat reminiscent of lead poisoning. A possible relation to vitamin C destruction is suggested.

To complete this list of items of military value, it might be mentioned that Dr. Louis J. Karnosh, of Western Reserve Medical School, had 100 cases of insomia treated with vitamin C and observed excellent improvement. It would seem that both C and B_1 could be useful in many cases of nervous disturbance.

HARRY N. HOLMES

OBERLIN COLLEGE

NATURAL AND SYNTHEIC INHIBITORS OF CHOLINE ESTERASE[1]

ACETYLCHOLINE and adrenaline, which are considered to be the chemical mediators of nervous impulses, or closely related to these mediators, are substituted methyl ethanol amines. It will be shown in this note that the fact that both compounds are N-methylated may have a physiological significance, since it links both of them to interaction with the same enzyme, choline esterase. This was indicated to us by consideration of the structure of physostigmine, the most powerful inhibitor of the esterase. A large part of its inhibiting action undoubtedly is due to the methyl urethane side chain as shown by the effect of drugs of the same structural type.[2] The structure of these compounds and of other strong inhibitors of the esterase, *e.g.*, methylene blue, suggests that the N-methyl group is part of the configuration essential for their inhibiting properties.

In addition to the N-methyl group in the methylurethane side chain, physostigmine contains two other N-methyl groups in its indole and pyrrolidine rings. The question arises whether these N-methyl groups contribute to the action of the drug. The N-methyl indole part is of particular interest since it relates the physostigmine structure to that of adrenochrome, a substituted N-methyl indole, which has been thought to be an oxidation product of adrenaline.[3]

We have studied the action of indole, N-methyl indole and oxidation products of adrenaline on choline esterase in human serum. The enzymatic hydrolysis of acetyl choline (0.016 molar) was followed by electrometric titration; 0.1 or 0.25 ml of serum were used in a total volume of 25 ml. The solution was 0.7 per cent. in regard to sodium chloride to exclude interference from varying sodium concentration.[4]

Physostigmine in H 10^{-6} molar concentrations produces a 50 per cent. inhibition of esterase under the conditions of our experiment. Indole gives a 50 per cent. inhibition in a molar concentration of about 10^{-2}. N-methyl indole is at least twice as active as indole. The exact values are difficult to determine, since the compound is only slightly soluble in water.

The oxidation products of adrenaline differed in their action on the esterase depending on the type of oxidation and on the p_H at which the oxidation was carried out. Products obtained by oxidation with iodate or catechol oxidase[5] at acid p_H do not inhibit the esterase. Solutions which contain the enzymatic oxidation product of adrenaline show a strong inhibiting action after being alkalinized. Oxidation with bromine leads to active compounds which inhibit the esterase to 50 per cent. in molar concentration of 10^{-4}. On the basis of these experiments it can be understood that samples of adrenaline show different degrees of inhibition depending on the extent to which they have been exposed to air. The sample of adrenaline least active inhibited the esterase to 50 per cent. in molar concentration of 2.5×10^{-3}. Another one which inhibited the esterase to 15 per cent. in molar concentration of 10^{-3} doubled its inhibiting effect after exposure to air in a thin layer for several days. A large part of the colored inhibitor can be removed by charcoal or by recrystallization.

These experiments suggest the possibility that under physiological conditions, metabolic products of adrenaline may be formed which have a strong inhibiting effect on choline esterase. Formation of active oxidation products of adrenaline would not only result in a disappearance of adrenaline *per se* but also, by inhibition of the esterase, in a slower removal of acetyl choline.

HEINRICH WAELSCH

HERBERT RACKOW

COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY

[6] Harry N. Holmes and Kathryn Campbell, *Jour. Lab. Clin. Med.*, 24: 1119, 1939.

[7] S. W. Marchmont-Robinson, *Jour. Lab. Clin. Med.*, 26: 1478, 1941.

[1] This work was supported by a grant from the Joshua Rosett Research Fund.

[2] E. Stedman, *Biochem. Jour.*, 20: 719, 1926; 23: 17, 1929; E. Stedman and E. Stedman, *Biochem. Jour.*, 25: 1147, 1931.

[3] D. E. Green and D. Richter, *Biochem. Jour.*, 31: 596, 1937.

[4] G. A. Alles and R. C. Hawes, *Jour. Biol. Chem.*, 133: 375, 1940.

[5] We are indebted to Dr. C. R. Dawson for the preparation of catechol oxidase.

BACTERIAL GROWTH FACTORS IN SOIL[1]

IN a study of the nutritional requirements of indigenous soil bacteria, isolated by non-selective plating methods, special attention was given to organisms unable to grow in a basal salts-glucose medium to which was added a mixture of ten amino-acids (or peptone) plus seven growth factors, or even in one containing yeast extract supplement. Such organisms, comprising approximately 20 per cent. of the isolates from soil, were found to grow well in yeast extract medium upon the addition of a heated aqueous extract of field or garden soil, more than 80 per cent. of them showing good or sub-maximal growth without the yeast extract. For the great majority of the 63 strains studied the growth-promoting properties of soil extract were dependent upon a factor or factors (not concerned with the ash constituents) present in the acetone, but not in the ether extract, and capable of being adsorbed by Norit and eluted with ammoniacal alcohol.

It has already been shown that certain vitamins may be present in soil. Thus Lilly and Leonian[2] have demonstrated the presence of thiamin, while the occurrence of biotin in plant and animal tissues readily accounts for its presence, particularly in well-fertilized soils. Furthermore West[3] has shown that measurable quantities of thiamin and biotin may be excreted by the roots of seedlings. Since the organisms studied by us, however, showed no growth in the presence of the growth factor supplement, which included thiamin, biotin, riboflavin, pyridoxin, pantothenic acid, nicotinic acid and inositol, it is suggested that the growth-promoting properties of soil extract for this group of bacteria are to be ascribed to factors other than those listed.

More than one such growth-promoting factor appears to be present in soil extract, one or more of which are capable of being synthesized by certain other soil organisms having simpler nutritional requirements. Thus it was found that for certain strains the nutrilite effect of soil extract could be replaced by a filtrate from cultures of bacteria capable of maximum development in the basal salts-sugar medium. For other organisms similar filtrates were ineffective, indicating distinctly different growth requirements. In the case of the relatively small number of isolates requiring yeast in addition to soil extract, it was found that the effect of yeast could be likewise supplied by filtrates of certain bacteria growing in the basal medium. The associative influence of organisms producing such by-products doubtless explains the ability of certain more fastidious bacteria to grow on the original plating medium which contained soil extract without additional nutritive supplements.

A. G. LOCHHEAD
F. E. CHASE

DIVISION OF BACTERIOLOGY AND DAIRY RESEARCH,
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OTTAWA

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A MICROSCALPEL FOR USE IN EXPERIMENTAL EMBRYOLOGY[1]

A MICROSCALPEL that has been found to be very suitable for many kinds of operations and dissections may be made from the cutting edge of a razor blade. Such small scalpels have been used with success, principally in the microsurgery of experimental amphibian embryology, but have also proved valuable in the dissection of annelids, copepods and insects. The scalpels are easily made and are usually prepared in lots of ten or more so that they may be discarded when dull without loss of time.

The razor blade used is of the thin, double-edged type. A narrow strip of steel, which bears one of the cutting edges is broken off by clamping the blade firmly in a hand vise, then bending the protruding part of the blade sharply against a glass plate or other smooth, flat surface (Fig. 1). It is important to clamp (*i.e.*, break off) as narrow a strip of the blade as can be firmly held in the hand vise for this will minimize the time required to finish the scalpel. Care should be exercised upon inserting the edge of the blade into the hand vise to avoid dulling or nicking the cutting edge.

The shaft of the microscalpel is made from a fine embroidery needle, the tip of the eye of which is ground away on a fine emery wheel or oil stone, leaving two prongs (Fig. 2). Between these prongs, the small portion fractured from the razor blade is fastened by means of solder (Fig. 3). In order to make a delicate joint, the soldering is best done with the use of a rosin base soldering flux and by first coating the prongs thinly with a layer of solder (tinning). One end of the razor edge is then coated with flux (only) and inserted between the tinned prongs of the needle. The prongs are pressed lightly upon the point

[1] Contribution No. 156 (Journal Series).
[2] V. G. Lilly and L. H. Leonian, SCIENCE, 89: 292, 1939.
[3] P. M. West, *Nature*, 144: 1050–1051, 1939.
[1] From the Division of Anatomy, University of California Medical School.

of a hot soldering iron, and a smooth, sweated union between the prongs and the strip of razor blade is obtained.

The shaft of the scalpel (*i.e.*, the needle) may now be clamped by its pointed end in a needle holder or pin vise, in order to facilitate shaping the blade of the microscalpel. The shaping is accomplished by grinding away the back of the small blade with a fine emery wheel or oil stone to the desired shape, exercising care to avoid grinding the cutting edge of the blade.

The shape of the blade and the angle which the blade makes with the shaft of the scalpel depend upon the use to which the scalpel is to be put. For the purposes of experimental embryology, the blade is ground to a gradually tapering, delicate point of nearly microscopic dimensions. A moderately fine blade is shown in Fig. 4.

Fig. 1

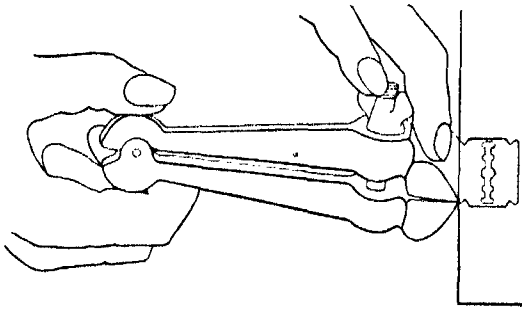


Fig. 2

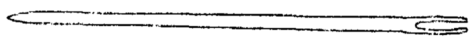


Fig. 3

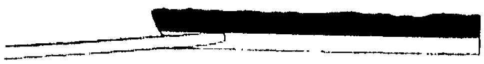
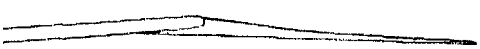


Fig. 4



In use, the shaft of the scalpel is held in a needle holder or pin vise. Incisions are made in amphibian embryos by inserting the tip of the blade into the tissue of the embryo and then gently stroking the surface of the tissue above the edge of the blade with a fine glass needle or hair loop. For coarser work, the scalpel may be used in conjunction with fine forceps or jeweler's tweezers.

With practice, a dozen of these small knives can be made in a half hour. It has been found most practical to store extra scalpels by sticking the pointed ends of their shafts into a large cork and then inserting the cork into a wide-mouthed bottle so that the blades are protected from moisture and mechanical damage. They also may be coated with oil or grease until ready for use.

ARTHUR B. BURCH

THE INSECTICIDAL ACTION OF PHENOTHIAZINE

PHENOTHIAZINE, an organic compound which is non-toxic to humans, is effective as a urinary antiseptic,[1] anthelmintic,[2] fungicide[3] and insecticide.[4] The compound offers promise as a substitute for arsenicals, especially in codling moth control.[4]

The effect of phenothiazine upon the American cockroach, *Periplaneta americana* (L.) was investigated. The compound is toxic to the roach, acting entirely by contact with the body surface. No toxic effect results when the chemical is taken into the alimentary canal. When applied to the body surface phenothiazine passes through the exoskeleton and is converted internally to a compound believed to be a conjugate of thionol, present in leuco form. The latter compound must reach a definite concentration in the haemolymph before the toxic effect is produced. The effective concentration of the thionol conjugate in the haemolymph is correlated with the particle size and with the quantity of phenothiazine in contact with the exoskeleton. The most rapid kill at the lowest concentration is produced with particles of the smallest size. When an equal amount of phenothiazine in a larger particle size is in contact with the body surface, the lethal concentration of the thionol conjugate in the haemolymph is not reached. In this case only a slight uncoordinated leg movement is evident, and recovery is rapid as the thionol conjugate is eliminated through the Malphigian tubules.

Ingested phenothiazine has no effect upon the roach, although undergoing oxidation primarily during its passage through the mid-intestine. The wall of the intestine is impermeable to phenothiazine and to the oxidation products formed.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE LAW OF GRAVITATION

IN this two hundred and ninety-ninth year since the birth of Sir Isaac Newton, which occurred Christmas day, 1642, according to the Old Style Calendar then in use in England, his law of gravitation is still on trial, but is winning, according to a report made by Dr. Fritz Zwicky, professor of theoretical physics at the California Institute of Technology, to the Astronomical Society of the Pacific.

The question is not whether the precise form of the law is Newton's or Einstein's, but the extent of its application whatever its form. Newton believed his law to be universal. "Every particle of matter in the universe attracts every other particle . . . " was Newton's formulation.

But it was a small universe in Newton's time. The extension of the force of gravity to the moon, and its action in producing the tides, were demonstrated by Newton himself. Its application to the planets and their satellites was readily verified in his time. Its application to comets was firmly established by the return of Halley's comet as predicted, seventy-seven years after the calculations were made.

But all this concerns only our immediate solar system, a small speck in a vast universe of stars. Do the stars also obey this law? To answer this question took more time. Double stars revolve about each other, but often require many years to complete a revolution, and are so far distant that the changes of position as seen in the telescope are of microscopic dimensions. It was not until 1830, more than a century and a half after the publication of Newton's law, that Savary was able to show that the motions of these bodies are elliptical and the law of gravitation therefore applies.

But these stars belong to our own galactic or milky way system, a huge conglomeration of stars, clusters and gaseous bodies, 100,000 light years in diameter and about 20,000 light years thick at the center. It is only one among billions of others like it scattered about in a great universe of galaxies that extends at least 100,000,000 light years in every direction. Do the same laws apply in these distant galaxies or spiral nebulae?

This is a much harder question to answer than any of the others, and the answer can not yet be regarded as complete. We believe that our own nebula or galaxy is revolving, but it takes 200,000 years to make one turn. Motions have been observed in our neighboring galaxy, Andromeda, only 870,000 light years away, which might be part of such a revolution, but it is too early to say.

Strangely enough, Dr. Zwicky finds the best evidence for the operation of gravity over inter-galactic distances, measured in millions of light years instead of millions of miles as in our solar system, in certain clusters of nebulae that occur. Imagine, a cluster of universes each one like our great milky way! One of these in the constellation of Coma is 45,000,000 light years distant and about 5,000,000 light years in diameter. Dr. Zwicky estimates that it contains over 2,000 galaxies; 650 have been counted.

The distribution of these galaxies within the sphere they occupy can be calculated on the basis of Newton's law of gravitation, and Dr. Zwicky finds that the actual distribution corresponds very nearly with that predicted by the law. Incidentally these clusters of nebulae could not have settled down to their present state in the short time of less than 10,000,000,000 years allowed by the advocates of the expanding universe. Besides supporting the general validity of Newton's law of gravitation, he says they also suggest that the universe is not expanding.

ECLIPSE OF THE STAR ALDEBARAN

IF, during the night of Monday, October 26, you see the moon, a few days past the full phase, approaching the bright star Aldebaran in the constellation of Taurus the bull, just keep on watching. You will be rewarded with a view of an occultation, which is what the astronomer calls an "eclipse" of a star by the moon.

The moon moves around the sky once a month from west to east. From new to full, the dark side is ahead, and from full to new the bright limb, on which the sun is shining, is in advance. Consequently when Aldebaran is occulted, the bright edge will cover the star. A pair of binoculars will make it easier to see. When, an hour or so later, the star emerges, its reappearance will be from behind the dark part of the moon. It will disappear and return to view instantaneously. There is no atmospheric layer around the moon to cause partial absorption of the star's light, and to make the star brighten gradually as the eclipse ends.

The exact times of the occultation are different in different parts of the country, but the Nautical Almanac Office of the U. S. Naval Observatory has worked them out for Washington and for three other stations. For Washington, the star disappears (on Oct. 27) at 2:11 A.M., EWT, and reappears at 3:37, EWT. For a location in western Massachusetts, the times are 2:23 and 3:51 A.M., EWT. For southern Illinois they are 12:46 and 2:11 A.M., CWT. Southern California will see the occultation start at 10:17 P.M., PWT, and end at 11:21 P.M., PWT, on the 26th.

Astronomers will watch this, as they do other occultations, in order to time it and to check accurately the movements of the moon. Occultations occur nightly, but those of a bright star are considerably rarer. Aldebaran is the brightest star that can ever be occulted.

ALLOYS OF METALS

A NEW method of making alloys of metals that do not mix when melted, and therefore can not be alloyed in this manner, was described at the Cleveland meeting of the American Society for Metals in a paper by M. L. Samuels, A. R. Elsea and K. Grube, research metallurgists of the Battelle Memorial Institute of Columbus, Ohio.

For example, aluminum and lead when melted do not dissolve in each other. However well the mixture is stirred, when it solidifies nearly all the lead is found at the bottom and nearly all the aluminum on the top, since lead is more than four times as heavy as aluminum.

But aluminum and tin do mix well when melted. On cooling, the aluminum, having the higher melting point, solidifies first in tree-like forms that interlace throughout the mixture. The spaces between are filled with the still molten tin. On further cooling, the tin solidifies and an alloy is produced in which the two metals are well and uniformly mixed throughout the mass.

It was found that this aluminum-tin alloy can be converted into an equally good aluminum-lead alloy by displacing the tin with lead. To do this, the alloy is heated in a pot to a temperature which melts the tin but not the aluminum. Molten lead is then poured on the top, and seeps into the metal, pushing the tin before it. The latter runs out through a hole in the bottom of the pot. In this way, an aluminum-lead alloy is produced having the same intermixture of metals that the aluminum-tin alloy had.

The method is applicable not only to metals that do not mix at all, but also to those that do not mix well enough to produce a good alloy, thus opening the way to improving these alloys. Thus copper and tin, when the tin content is high, do not mix well. By first making an alloy of copper and bismuth, and later replacing the bismuth with tin, a superior and hard alloy was produced. In fact, a number of impossible alloys were produced and several difficult ones were improved.

MAHOGANY TREES

MAHOGANY may come from cultivated forests of African trees grown in Florida. Experimental plantings of Rhodesian mahogany trees on the grounds of the subtropical experiment station of the University of Florida, near Homestead, are catching up in height with native fast-growing pines twice their age, have trunks twice the diameter of pines as old as themselves, and appear to be forming wood four or five times as fast.

On the strength of this performance, S. J. Lynch and H. S. Wolfe, of the Experiment Station staff, express the opinion that they appear to be the most promising hardwoods for reforestation in South Florida that have been tested by the Sub-Tropical Experiment Station.

The trees belong to one of two African genera of mahoganies, and are known botanically as Khaya nyasica. To distinguish them from other African mahogany species, it is proposed to call this species East African or Rhodesian mahogany. The African mahoganies generally are closely related to the American genus, Swietenia.

The oldest trees in the plantings, although set out in rather unpromising-looking sites only twelve years ago, already have seven- to eight-inch trunks and average 40 feet in height. Although distinctly tropical in origin, they have survived several cold spells, including one freeze when the temperature dropped to 27 degrees Fahrenheit. So far, the trees have not been attacked by insect pests or diseases; but botanists are chary about claiming immunity for them on that score.

RED AND VIOLET SNOW

FIELDS of red and purple snow in the Northland are due to microscopic plants. These single-celled algae, one of the most primitive groups of living things, were investigated by Erzsébet Kol, a Hungarian woman working under a Smithsonian fellowship. Her report of the vivid "blooms" in Alaskan mountain ranges has been published by the Smithsonian Institution. In this forbidding Arctic environment, she found nearly fifty examples of the tiny plants living in almost infinite numbers on perpetual ice and snow.

After collecting living specimens, Miss Kol went to her laboratory high in the Swiss Alps where she planned to cultivate and study this strange form of life. War has now severed communication with her. Except for news of the loss of her living specimens, no word has been received on how the war has affected the project.

Previous reports indicated that these algae vary in character. One wouldn't live on ice; another wouldn't live on snow. And there are striking changes in types, depending on whether surrounding mountain slopes are acid or alkaline in composition. This is probably due to their reliance on air-borne particles of decomposing and shattered rock for food. Dust dissolves slowly in the moisture on snow or ice surfaces, providing the minerals essential for life.

The snow and ice plants, it is believed, serve as the chief food for some other form of life, which in turn supports higher forms. However, the life cycle of the vividly colored organisms remains unknown.

INDIAN SUMMER

THE first sharp frosts came early this year over a wide stretch of this country; Indian summer is here correspondingly soon. The quiet, warm autumn days, with calm air or, at most, moderate, drying winds, are good for hastening the maturing of the crops. They dry the last surplus water out of corn, beans and other seed crops, mellow late apples and pears, and put the finishing touches on pumpkins and hard-shelled squashes left orphans by their frost-killed vines.

There is no fixed date for the arrival of Indian summer, no definite duration for the season. It is not even necessary that a killing frost come first, though that is a usual preliminary. Any warm, quiet spell, following cool or chill fall weather, may be called Indian summer. In some fortunate falls there may be more than one such season.

Meteorological background for Indian summer is a "stalled" high-pressure area somewhere in the Southeast, with a large area of low pressure backed up in or near the Yukon valley. There will then be little air movement off the main body of the continent, and even the low-angled autumn sun can warm up the air. Sometimes Indian summer temperatures rival those of actual summer: 90-degree days are not uncommon, though nights are always cool.

Only in the English-speaking parts of North America is the name Indian summer used. Similar seasons in Europe have names dating back to the Middle Ages, ascribing them to various autumnal saints; usually St. Martin, whose feast comes on November 11. The ancient Greeks had a belief that these calm spells were a gift of the gods for the special benefit of the kingfisher, whose name in Greek is halcyon. The kingfisher was supposed to build a floating nest on the sea, and to sing sweetly to its brood; whence the phrase "halcyon days." Actually of course the kingfisher builds its nest in a burrow

in the stream or lake bank, and is not at all notable for vocal virtuosity. However, that's just some more of cold-blooded modern science's upsetting of pleasant old fancies.

The glistening gossamer threads that float through the air and catch on trees and shrubbery during Indian summer are a source of mystery to many persons. They look just like spiderweb, only you don't see any spiders. Actually they are spiderwebs, and if you look sharp at the right time, you may see the spiders. But as a rule you'll have to get up fairly early, and on just the right days. Very tiny spiders, recently hatched, climb out on the ends of twigs when very gentle air-warmed currents are rising. They spin these thin threads each with a tiny parachute-like tuft at its end. When the lift becomes great enough, away they sail, seeking their fortunes like true Argonaut adventurers. It is the method of migration-dispersal followed by these spider species.

These glistening threads, too, were the source of an old folk-belief. It very likely is older than Christianity; but at present, and for many generations past, peasants in the Catholic parts of Europe call them various names that all translate as "Mary's threads." Because they are so delicate, and perhaps because they have a bluish glint in the autumn sunlight, they are supposed to be ravelings from Our Lady's veil, drifting down like a benediction on a quiet world.—Frank Thone.

ROUNDING UP ANTELOPES

Pronghorn antelope, the fastest things that run on four legs on this continent, have been very successfully rounded up by airplane, for transplantation in trucks to new places on the range. In the *Journal of Wildlife Management*, Lee William Fisher, of the Texas Game, Fish and Oyster Commission, tells how, in illustrated detail.

Pronghorn transplantation is desirable, Mr. Fisher explains, because while the fleet little animals get along excellently with cattle on their range, they simply don't "mix" with sheep. So it is the practice so far as possible to remove them from sheep country and release them on cattle lands, where they are welcome.

The first round-ups of pronghorn in Texas were carried out by men on horseback. However, the method proved slow and rather costly. Mr. Fisher had noticed, during airplane flights made for the purpose of counting pronghorn herds, that the animals would run away from the sound of the motor. So he tried some experiments, and soon learned that small pronghorn herds could be bunched into one big herd, and then "drifted" in any desired direction, by flying a plane on the opposite side, at heights between 50 and 500 feet. A small, low-powered, slow-speed plane was found most suitable for the purpose, as well as very economical to operate. The herds are "drifted" into a big wire corral, and driven from that into a smaller pen made of strong cord. From this they are removed and examined, weighed and loaded into trucks for transportation to their new homes.

Since adoption of this method, 467 animals have been trapped and transported, with a loss of only three killed. The whole cost for each animal was only about $4.30.

ITEMS

Tyrothricin, a potent germ-killing substance obtained from bacilli that live in the soil, has been tried with "discouraging" results in sinus disease and infections of the nose and throat of the kind most laymen refer to as colds. Use of the substance in these conditions and its apparent failure in general to benefit the patients was reported by Dr. J. R. Lindsay, of Chicago, at the meeting of the American Academy of Ophthalmology and Otolaryngology. Tyrothricin is the crude substance isolated by Dr. René Dubos, at the Rockefeller Institute, and contains two crystalline substances, gramicidin and tyrocidine. Gramicidin has been hailed as an important new chemical remedy for diseases caused by germs of the gram negative group. Dr. Lindsay's experience with the parent substance, tyrothricin, shows one group of infections for which it is ineffective. Tyrothricin can not be given by injection, because it must be kept out of the blood stream since it separates hemoglobin from the red blood cells. So Dr. Lindsay used it in the nose, throat and sinuses by spraying, swabbing and dropping.

Hope for doubling the nation's stockpile of morphine through use of a potentiating drug is discouraged by research, reported by Dr. Howard L. Andrews, U. S. Public Health Service, in the *Journal* of the American Medical Association. By giving prostigmine methylsulfate with morphine, it had previously been reported that pain could be relieved with only about half the amount of morphine usually required when given alone. Besides conserving morphine, this potentiating drug might also reduce the risk of morphine addiction developing from morphine given to relieve pain. As a result of studies at the U. S. Public Health Service Hospital at Lexington, Ky., where narcotic drug addicts are treated, Dr. Andrews concludes: "It appears that the combination morphine-prostigmine methylsulfate is not significantly more effective in raising the pain threshold than morphine alone and that the addition of prostigmine methylsulfate does not appreciably change the rate at which tolerance is developed."

Pink-fleshed trout, and presumably other fish also, contain more vitamin A than white-fleshed trout, according to preliminary experiments made by Dr. C. H. Clausen, of the University of Colorado School of Medicine. His discovery came in studies undertaken at the request of Director C. N. Feast, of the Colorado Game and Fish Department, who wanted to know why flesh of the same sort of fish, such as brook or rainbow trout, may graduate from white to a deep clear pink. The pink flesh contains more vitamin A than the white flesh, and Dr. Clausen also found more vitamin A in the flesh of crustacea, main food of the trout, which lived where the pink-fleshed fish do. Dr. C. E. Hagie, educational manager of the department, points out that foods rich in vitamin A, fed to trout in ponds where they are reared tame for the table, may help pond-owners produce only pink-fleshed fish, which are considered more attractive, as red salmon are considered more attractive than those with paler meat. The experiments are being continued.

SCIENCE

VOL. 96 FRIDAY, OCTOBER 30, 1942 No. 2496

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

CHEMICAL STRUCTURE OF CYTOPLASM

By Dr. R. R. BENSLEY

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IN a recent note written as a supplement to a symposium on the structure of protoplasm, K. H. Meyer[1] summarizes Seifriz's view of the structure of protoplasm as follows: "the ultimate structural units of the living substance are probably linear molecules or micellae so arranged as to form a framework" and "the living substance is composed of a true network of primary valence chains which at several points are tied together by chemical bridges held by molecular cohesion (to-day one would say residual valences or hydrogen bonds)." If Meyer had substituted in the first statement the work "some" for "ultimate" and left out the framework which requires further definition, and in the second statement had substituted the word "contains" for "is composed of" this would be acceptable to the majority of students of cell structure. X-ray diffraction and birefringence studies have brought convincing support to the conception of structural constituents in protoplasm which Seifriz[2] with so much genius and foresight advanced a decade and a half ago.

This theory, however, interprets only some of the properties of protoplasm. These as listed by Seifriz[3] are: "contractility, elasticity, cohesiveness, rigidity, and tensile strength." All these may be possessed by non-living systems. Protoplasm on the contrary respires, excretes, performs complicated chemical operations, uses or liberates energy and reproduces its own substance in kind. This metabolism is mediated by a multitude of intracellular enzymes and carriers and

[1] K. H. Meyer, "The Structure of Protoplasm," Iowa State College, p. 267, 1942.

[2] W. Seifriz, *Brit. Jour. Exp. Biol.*, 1: 431, 1923–4.

[3] W. Seifriz, *Am. Nat.*, 63: 410, 1929.

can be imitated in part *in vitro* but in the cell is characterized by speed, orderliness and rhythm not to be found in a random mixture of chemical substances in solution.

This dilemma in the application of the concept of molecular pattern to the problem of protoplasmic structure has been fully appreciated by Sponsler,[4] Sponsler and Bath[5] and the late Laurence Moyer,[6] who examined the possibilities of the orderly attachment of enzymes, carriers, lipids, etc., to polypeptid chains by hydrogen bonds, von der Waal's forces and salt and sulfur bridges. Sponsler also recognized the presence of microscopic and submicroscopic particulates and discussed the formation of them by folding of polypeptid chains.

This is all very plausible, and useful, in so far as it is capable of experimental test or contributes to the discovery of new methods of investigation. It is a laudable effort to reduce the nature of living substance to a monistic formula.

Protoplasm, however, does not possess either microscopic or submicroscopic homogeneity. Even when it seems optically structureless it may conceal behind the mask of simplicity those local differences of organization which express themselves in determinate cleavage. Often protoplasm is composed of distinct, different and to some extent separable parts. This was demonstrated by Reinke and Rodewald[7] when they pressed out the liquid protoplasm of *Aethalium septicum* and so divided it into liquid and solid fractions, and by innumerable chemists since who have extracted cells with saline solutions and found that only part of them dissolved.

It would seem to be an axiom of analytic chemistry to separate separable things before proceeding to their analysis. The alternative method of mixing all the constituents of the cell as thoroughly as possible and then obtaining from the mixture substances in pure form by skilful chemical procedures has yielded brilliant results in the field of hormones, enzymes, nucleic acids, etc., but has left us in ignorance of the protein structural substrate of the cell and of the distribution and spatial relationships of the active substances.

The possibilities of the method of separating separable things first have been developed in this laboratory and more recently by Claude at the Rockefeller Institute in the separation and preliminary analysis of mitochondria and of several types of submicroscopic particulate components of protoplasm and in the isolation of the structural proteins from the difficultly soluble cytoplasmic components. It is my purpose to review briefly the progress which has been made in this field.

Structural Proteins

The difficultly soluble portions of cells have been much neglected by biochemists, presumably because they were impressed by the ease with which proteins may be denatured and by the fact that such insoluble residues of organs always contain connective tissues. I shared this point of view until Hoerr and I[8] began to work with frozen dried material prepared by the Altmann-Gersh method. This method afforded an opportunity, by the use of freehand sections, to introduce solvent solutions to the interior of a chemically unaltered cell without encountering the obstacle of semi-permeability. In such preparations of the liver of the guinea pig treated with 0.85 per cent. NaCl solution the mobile protein of the cell quickly dissolved but left behind a morphologically complete cell with mitochondria, nuclear chromatin, cell and nuclear membranes. Treatment with $\frac{N}{200}$ ammonia solution removed the mitochondria and nuclear chromatin but left behind a cell with membrane, cytoplasmic substrate, nuclear membrane and linin threads. This residue we termed structural protein. We were first unable to dissolve in it anything but strong alkali. From this solution it precipitated on neutralization in membranous floccules with fibers running through them. On repeated solution and precipitation the substance became more flocculent and less fibrous and evidently had undergone some hydrolysis. To this material we gave the name *ellipsin* in recognition of the long hiatus in our study of the cell during which structural considerations had been jettisoned by those who believed that the liquid state excluded them.

Mirsky[9] reported the portion of the eggs of Arbacia and Strongylocentrotus insoluble in M_1KCl solution to be increased after fertilization, and Moore and Miller[10] found that the eggs of Strongylocentrotus which were isotropic became anisotropic in three minutes after fertilization indicating an orientation of structural elements.

In 1938 I[11] reported that a portion of the washed hepatic cell was soluble in stronger salt solution (10 per cent. NaCl) yielding highly viscous solutions with pronounced elastic properties. Those solutions precipitated on dilution or acidification as discrete fibers of great length which tended to assemble side by side

[4] O. L. Sponsler, "The Cell and Protoplasm," p. 166, The Science Press, 1940.

[5] O. L. Sponsler and J. D. Bath, "The Structure of Protoplasm," p. 41, Iowa State College Press, 1942.

[6] L. S. Moyer, "The Structure of Protoplasm," p. 23, Iowa State College Press, 1942.

[7] J. Reinke and H. Rodewald, *Untersuch. a. d. bot. Lat. der. Universitat*, pp. i–viii and 1–70, Göttingen, Heft 2, 1881.

[8] R. R. Bensley and N. L. Hoerr, *Anat. Rec.*, 60: 251, 1934.

[9] A. E. Mirsky, SCIENCE, 84: 333, 1936.

[10] A. R. Moore and W. A. Miller, *Proc. Soc. Exp. Biol. Med.*, 36: 835, 1937.

[11] R. R. Bensley, *Anat. Rec.*, 72: 351, 1938.

into fascicles. Soon after formation the mass of fibers contracted into a knot. To this substance I gave the name *plasmosin*, because of a fancied resemblance to myosin, reserving the name *ellipsin* for the residual substance not soluble in 10 per cent. NaCl.

In 1940 Banga and Szent-Györgyi[12] by extracting washed kidney tissue with a 30 per cent. solution of urea obtained a similar viscous extract which when precipitated in fibrous form gave an x-ray diagram similar to myosin B. The insoluble residue, insoluble either in saline solutions or 30 per cent. urea solution, when dissolved in alkaline solution exhibited streaming birefringence.

I am not sure that the fractions obtained by Banga and Szent-Györgyi are the same as those of Hoerr and the writer, because urea solutions are under suspicion by reason of their capacity of converting corpuscular proteins into fibrous proteins,[13] but the general trend of their work is the same and these distinguished chemists are not at all embarrassed by the possibility of denaturation.

My first preparations of plasmosin were highly contaminated by other substances since I found it difficult to purify by repeated solution and precipitation. Lazarow, my assistant, however, working in a cold room at + 2° C. and transferring the balloon of fibers to fresh solvent before it had contracted into a mass was able to redissolve and reprecipitate several times. Also we found that unless the water used in dilution was buffered to pH 6.8 with citrate or phosphate buffer much protein was adsorbed by the fibers.

The purified product contained 3.7 per cent. of phosphorus and gave positive pentose and purin base reactions. It was obviously a nucleoprotein. This fact would suggest to many minds its origin from the nucleus. The idea that nucleoproteins are confined to the nucleus has, however, been breaking down owing to the discovery that many active components of cells have a nucleotide structure and the discovery of Claude[14] that the particulates contain nucleoprotein. Casperson and Schulz[15] also have demonstrated the presence of nucleoprotein in cytoplasm by spectrophotometric methods. I would not wish to reject the idea that the nuclei contain plasmosin, but the rapid rise in viscosity of suspensions of washed cells in 10 per cent. NaCl solution compared with the slow rate of extraction of the nuclear chromatin in the same solution and the rapid extraction of plasmosin from frozen dried cells without much loss of nuclear chromatin inclines me to the opinion I previously expressed that it is in large measure a constituent of cytoplasm. Whether it originates there or is produced in the nucleus is of course an interesting topic for speculation and research.

[12] I. Banga and A. Szent-Györgyi, SCIENCE, 92: 514, 1940.

[13] W. T. Astbury, *Symposia on Quantitative Biology*, Cold Spring Harbor, 6: 120, 1938.

[14] A. Claude, SCIENCE, 91: 77, 1940.

[15] G. Casperson and J. Schulz, *Proc. Nat. Acad. Sci.*, 26: 507, 1940.

Plasmosin in solution in 10 per cent. NaCl dialysed against distilled water lightly buffered to pH 6.9 with phosphate buffer first precipitates as fibers, then the precipitate swells into a gel, and finally redissolves as the electrolyte is progressively reduced. In this state it has an isoelectric point of about pH 3.2. Thus, plasmosin may be extracted from cells by strong solutions of NaCl at a level of pH at which most of the mobile proteins are insoluble. Plasmosin is also soluble in 30 per cent. urea solution.

The portion of the liver cell which remains after removal of mobile proteins, mitochondria, submicroscopic particulates, nuclear chromatin and plasmosin represents cell and nuclear membranes, substrate of cytoplasm and linin threads. It is completely soluble in $\frac{N}{2}$ sodium hydrate and is reprecipitated on neutralization. The preparation carries about 25 per cent. of its dry weight of lipids. The preparation is phosphorus free and thus my original suggestion that it was a denatured form of plasmosin can not be sustained. I have suggested that the name *ellipsin* be retained for this material, although it seems hardly possible that it represents a single substance.

It is obvious that plasmosin is the substance associated with the variable solation-gelation phenomena and possibly in an oriented state with spindle and aster formation, while ellipsin is concerned with the more stable structural substrate of the cell such as membrane and perhaps intracellular fibril formation. The fact that we have produced membranous sheets which included fibers and have a lipid content of about 25 per cent. of dry weight should add weight to Schmitt's[16] conception of alternating protein and bi-molecular phospholipid components in cell membranes.

The amount of these structural proteins in cells in spite of the impressive showing which they make under the microscope is small. As is well known the fibrous macromolecules are capable of producing high viscosity at low concentration.

Particulate Components of Protoplasm

The fact that certain of the particulate components of protoplasm have sufficient stability in ordinary saline solution to permit their isolation should have been apparent from Plosz's[17] (1872) experiments with which I had been familiar for many years, but I did not perceive this at first and had to learn it by the

[16] F. O. Schmitt, *Physiol. Rev.*, 19: 270, 1939.

[17] P. Plosz, *Arch. f. d. ges. Physiol.*, 7: 371, 1873.

hard way of study of frozen dried material and fresh cells. Warburg[18] too had partially separated mitochondria in 1912 and noted their participation in the oxygen uptake of saline extracts of liver. However, Hoerr and I[19, 20] succeeded in 1934, 1937, in separating mitochondria from liver cells and making preliminary analyses. I had no suspicion at first that still smaller particulates were present in the liver cell until Lazarow, by long-continued centrifugation, obtained a glassy cherry red pellet composed of particles so minute that they were quite invisible under the microscope, but showed in the dark field of the cardioid condenser a shimmering field of light in which individual particles could with difficulty be distinguished. We were investigating this particle when Claude[14] announced his discovery of the presence of submicroscopic particulates in clarified saline extracts of embryo chick. Claude's particles contained nucleoprotein and phospholipid, the latter in part acetal phosphatid, which we were later able to confirm for mitochondria and the red pellet from liver. Claude thought that his particles were mitochondria which clearly could not be the case since mitochondria are not submicroscopic in size. The fundamental idea of kinship between these two components is, however, not to be so summarily rejected, since we know nothing of the antecedents or the products of either.

It is noteworthy that Claude[21] had previously found the virus of chick sarcoma associated with a similar particulate and that Stern and Wyckoff[22] recovered a pigmented pellet from liver extracts which had catalase activity.

In case any one should be inclined to regard mitochondria and the submicroscopic particulates as unimportant and casual products of cell metabolism or the result of temporary flocculation of cell constituents I would recommend that they suspend judgment until they learn of the lipid and enzyme content of these structures and their extraordinarily complex composition.

The analysis of particulate components of cytoplasm is only as good as the species-purity of the preparation and much effort has been expended on this phase of the work. It is quite certain that the original preparations of hepatic mitochondria which were separated at rather high speeds were contaminated with glycogen which is also particulate[23] and with the red submicroscopic particle and it is equally certain that the fractions obtained by Claude[24] by time fractionation at high speed were mixtures. The general trend of Claude's analyses of his fractions, however, accords well with our analyses of preparations made with much greater care, but the quantitative results are different.

Both mitochondria and submicroscopics have a high water content which, however, we have not been able to determine with accuracy owing to the unknown factor of dilatancy operating while the centrifuge is coming to rest. The results were for mitochondria 82.5 per cent., for submicroscopics 89.8 per cent., which for the reasons stated are probably too high.

Mitochondria and submicroscopic particulates are stable in 0.85 per cent. NaCl solutions but swell and lose substance if the electrolyte content is much reduced. They dissolve in water on the alkaline and on the acid side of their pH stability range. The latter has not been determined with accuracy but is known to be dependent also on electrolyte concentration. We have not been able to find that the stability is much influenced by the substitution of NaCl for the normal inorganic constituents of the cell water, but the enzymatic activities apparently are.

Qualitatively, mitochondria and submicroscopic particulates are similar in composition but there are quantitative differences.

The following substances have been identified chemically in both groups: protein, nucleoprotein, flavoprotein, triglycerides, lecithin, sterol and vitamin A, the latter by Goerner and Goerner.[25] The submicroscopics have a higher content of lipids, nucleoprotein, flavoprotein and water than mitochondria. The yellow color of mitochondria and the cherry red color of submicroscopic particles are due in part at least to flavoproteins. This has been confirmed by extraction of riboflavin and its conversion by the action of light in alkaline solution into chloroform-soluble lumiflavin.

The succinoxidase system has been demonstrated in both mitochondria and submicroscopics by Lazarow and Barrón.[26] Both give a moderate positive reaction for cytochrome oxidase with the nadi reagent, but the presence of Cytochrome C has not yet been confirmed by spectroscopic study. Both catalyse the decomposition of hydrogen peroxide.

Kabat[27] has demonstrated the greater concentration of phosphatase in a particulate from kidney separated from clarified suspensions at 27,000 RPM and has made interesting suggestions as to the function of particulates in the orderly assembling of members

18 O. Warburg, *Arch. f. d. ges. Physiol.*, 54: 595, 1912.
19 R. R. Bensley and N. L. Hoerr, *Anat. Rec.*, 60: 449, 1934.
20 R. R. Bensley, *Anat. Rec.*, 69: 341, 1937.
21 A. Claude, SCIENCE, 90: 213, 1939.
22 K. G. Stern and R. W. G. Wyckoff, *Jour. Biol. Chem.*, 124: 573, 1938.
23 A. Lazarow, SCIENCE, 95: 48, 1942.
24 A. Claude, *Symposia on Quantitative Biology*, Cold Spring Harbor, 9: 263, 1941.
25 A. Goerner and M. M. Goerner, *Jour. Biol. Chem.*, 123: 57, 1938; A. Goerner, *Jour. Biol. Chem.*, 122: 529, 1937–38.
26 A. Lazarow and E. S. G. Barrón, *Anat. Rec.*, 79: 41, Suppl.
27 E. A. Kabat, SCIENCE, 93: 44, 1940.

of enzyme carrier systems which recall earlier suggestions made on the same topic by Stern.[28]

The high lipid content of the mitochondria and particulates calls for some comment. Dry mitochondria contain about 34 per cent. of lipids; dry particulates as high as 51 per cent. Both figures are much higher than the average content of the whole cell. Therefore other portions of the cell contain much less than the average. Recent quantitative studies of this distribution reveal that structural proteins and particulates in the liver together carry about 90 per cent. of the total dispersed lipids and as high as 98 per cent. of the phospholipids. These determinations must be made on cells without an oil phase. Plasmosin contains when purified little fat, about 4 per cent., the ellipsin residue about 25 per cent. Thus, in the liver the interparticulate liquid contains little disperse fat and almost no phospholipid. These substances are largely contained in these little packets which I have called particulates and bound in the membranous and fibrous portion of the cell.

On the other hand, the interparticulate portion of the cytoplasm contains much protein, probably for the most part of the corpuscular or globular type. It also contains some flavoproteins but does not oxidize succinate, indicating that some essential member of the succinoxidase chain is missing. I do not know what the content of Wyckoff's macromolecular substances is or where they fit into this conception of protoplasm.

The fat distribution in mitochondria and in particulates does not differ in any important respect from that of the whole cell. Our previous estimates of lecithin were too low owing to the use of the unreliable acetone precipitation method. Phospholipid estimated as lecithin from phosphorus determinations show a content of lecithin of 45 to 58 per cent. of the total lipids. A positive Schiff reaction indicates a content of acetal phosphatid. The distribution as to lecithin kephalin and sphingomyelin has not been determined. We have not yet determined the inorganic constituents of the particulates.

Cytoplasm thus has no ultimate structural unit but consists instead of several perhaps many different types of units, all cooperating in an orderly fashion to produce that ensemble of properties which we call life. At the present time our knowledge is very incomplete but we can recognize the following categories:

(1) Those units upon which the integrity of the cell as a unit of structure, the maintenance of its organization, and those properties enumerated by Seifriz, depend. In these units the fibrous proteins and nucleoproteins with associated lipids, etc., described play an important role.

(2) Particulates, microscopic and submicroscopic, of highly complex composition mediating special chemical processes.

(3) The interparticulate liquid menstruum also of complex composition but at present little understood.

The methods and quantitative results upon which the foregoing statements are based will be published elsewhere in collaboration with Dr. Lazarow, who for several years has assisted me in the work.

Obviously the possibility of separating mitochondria and particulates and of isolating the structural proteins for chemical study opens up a rich field for further research. The localization of enzyme and carrier systems, vitamins and hormones, and the viruses, functional changes in composition, the tracing of radioactive isotopes into the interior of the cell and the further fractionation of the submicroscopic particles by more refined methods all offer inviting opportunities to the inquiring mind.

It is a pleasure to acknowledge that my work has been much helped by the loyal and generous attitude of my colleagues and former students in the Department of Anatomy and by the generous contribution of funds from the Rockefeller grant and from the Wallace C. and Clara A. Abbott Memorial Fund of the University of Chicago.

It is a pleasure also to reflect that the funds at my disposal have never been large enough to tempt me to abandon investigation for direction of others, and thus to miss in these years of retirement the joys that come, in fullest measure, only to those who satisfy their desire for knowledge by a direct and personal appeal to nature by research.

WARTIME MAINTENANCE OF SCIENTIFIC PRODUCTION

By Dr. J. S. NICHOLAS

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MANY theses have been founded on the relationship of supply and demand. When the President made his wartime demands on industry, few thought that the stated objectives could be attained. Although in some cases there has not been complete attainment, in the majority and dominant aspects of the program

[28] K. G. Stern, *Symposia on Quantitative Biology*, Cold Spring Harbor, 7: 312, 1939.

there has been generally an increase in production beyond all expectation—in some cases greatly exceeding the amount for which the President asked.

There are brightening aspects of production. With typical American spirit we have taken regard of the impossible and have proved it possible. Output has been speeded; the number of man-power hours necessary for each operation has been decreased. Technical details of model changes and modification have been met with a just perceptible ripple in the flow of output. Material supplies have literally been created either by substitution of more accessible products or the more efficient handling of old ones. In industry, both production and supply have worked miracles.

The academic production, however, has suffered by contrast with the industrial. The demands upon industry have been proportionately small compared with those presented to the academic circle. Industry was faced with an immediately crystallized objective and the operations incident to its realization could be clearly sketched and evaluated. Its needs were recognized and men were detailed either from other less essential plants or from our colleges to make these operations practicable. Conditions within the universities were not so simple, for various reasons.

In the first place, the armed services had for some time been able to develop little in the lines of research incident to the utilization of equipment of modern warfare. Present survey shows that the Army had plans for modernized combat units, but these were paper plans constructed in the main without the benefit of practice and observation necessary for the perfection of practical organized tactical combat units.

In order to utilize the new appliances which were to be employed against an enemy with years of practice in the field, there resulted immediately an exceedingly concentrated call upon academic resources for practical research strictly applied to the combat mechanics of new apparatus. This naturally necessitated short cuts of all types, and the staff and student body of our universities have contributed much toward the rapid organization and rapid advances along these lines.

The question of demand brought about a situation which our colleges and universities were more unprepared to face than had been the army with reference to mechanized warfare. Most academic staffs had been built up over a period of years with the idea of maximum teaching load and but a small proportion of time had been designated for research. However, a few more public-spirited institutions, which had been far-sighted enough to allot to research and development a larger share, were immediately available for the government's call and their staffs have formed the backbone of research in the transfer from the needs of peace to the necessities for war. This change of emphasis involved the total effort of some of our science departments, with, in some cases, a complete demolition of what had been a useful academic team.

The fact that we are participating in total war which demands total effort can not be overemphasized. The total effort of academic groups has so far been harnessed in only a desultory fashion. Research men have been called into the services or into governmental organizations without thought for the future. No replacements exist in some fields for the men who have been withdrawn to necessary and urgent work, either in industry, governmental research or armed services.

No advanced planning could have foreseen the extent of our academic involvement but now the time has come when the allocation of certain groups of personnel must be accomplished as ruthlessly as is the work of the local tire rationing boards. This is peculiarly so in highly specialized and trained groups in which we have a sharply limited supply. Some of these supplies have reached a level so low that replacement production is seriously impeded. In the academic field we have been muddling through so far by changing the working load, by accelerating schedules and eliminating vacation time. This would considerably increase output if we retained an adequate staff on the academic production line, but this it has been impossible to maintain.

The fields from which the greatest amount of research personnel has been removed for war effort are those which now have the greatest teaching load in production. Specifically, the shortages are greatest in physics and mathematics, which are focal points of emphasis in the new armed forces' program now rapidly becoming installed in our colleges and universities. The enrolments in these fields, particularly during the immediate future, will be far greater than even a full peacetime staff could handle, for many students in upper classes will, by the service regulation, be compelled to complete this training. Depletion of the staff by the part-time or full-time participation in other war activities must be recognized as a fact. We must produce substitutes in these fields just as energetically as we would produce a rubber substitute.

For the past eight months we have been robbing Peter to pay Paul in the academic world. Bidding for available men in a field has proceeded with alacrity as one institution has taken men from another in order to satisfy its needs. The original supplies have been exhausted, but there is a new source to be tapped; the problem now appears possible of solution, at least in part, by the appropriate transfer and

utilization of trained men from other fields. Geologists and economists can take over the teaching load in physics, chemistry or mathematics. Biologists and psychologists can take over other teaching duties in addition to those incident to their own important output, which must be maintained. It is possible that some teachers in history, classics, linguistics, anthropology and literature may also be fitted to teach in mathematics, particularly at elementary levels. The personnel of our schools and departments of education should be particularly applicable to such needs.

A teacher is a teacher, irrespective of the branch of learning. The methods and the students are the same—only the subject-matter is different. The university and college grade teacher can and must carry his personality and intellectual acumen into other fields of endeavor in addition to his own. This, while it may not be easy, is an immediate necessity. The standards and detail of subject-matter must be clearly presented to the substitute volunteers, and possibly refresher courses must be given by the specialists still remaining on the staff. This is one obvious source of man-power which can be utilized in the production of scientifically trained men.

A second source may be drawn upon from individuals who are in administration and have been removed from student problems for a long period of time. Many institutions are carrying a too large proportion of administrative officers, some of whom could be usefully reallocated at the universities' main job of production, teaching.

There is a third source as yet practically undeveloped and that is in the field of woman power in academic teaching. For many years women have been discouraged from attempting to enter academic fields. Now we need all of them that have been adequately trained and unfortunately that number is exceedingly limited, for when their placement has been made difficult for many years and their acceptance even by our leading female colleges has been rather tardy, all too few first-rate women scientists have been trained. To-day we could use ten times the numbers that are available if only the peace-time prejudices could be overcome.

From the above it is clear that there are many phases to the battle of scientific personnel production. One phase can not be overemphasized sufficiently, and rests with the personal conscience of many a teacher of science. It is easy to leave one's post and to accept new responsibilities, but are they always of greater utility than the accustomed routine or its possibility of rejuvenated potentiality? The importance of what you are now doing and how to intensify your effort must be evaluated by you individually. The home front is a pressing one which demands the best that we have if we are to keep our training program intact. We can not proceed on the simple substitute principle. A greater and more far-reaching view is demanded with a look toward a war future which is longer than any of us had ever anticipated. With this in mind let no one belittle his talents and opportunities on the home front of academic production. They are important, vital and of a degree of necessity which the country now demands. We will win the war—we must have trained thinking men to win and maintain the peace.

OBITUARY

ROSS AIKEN GORTNER

1885–1942

Death came Wednesday morning, September 30, to Ross Aiken Gortner, 57, chief of the Division of Biochemistry of the University of Minnesota, eminent scientist and scholar. Dr. Gortner had been able to carry on his work up to a few days before his passing, which resulted from a heart attack. He was first stricken with a heart ailment in the summer of 1938, and while the curtailment of his normal life of seemingly boundless energy was a sore trial to his spirit he made the adjustment with remarkable equanimity. Thus he was able to continue most of the scientific and social contacts to which he had been accustomed, and also carry the load of executive work of an expanding department as well as lecture to his classes, with few interruptions.

Dr. R. A. Gortner was born at O'Neill, Nebraska, on March 20, 1885. After graduation from Nebraska Wesleyan University in 1907 he earned his M.S. degree in 1908 from the University of Toronto, where he worked with the late Dr. W. Lash Miller, and his Ph.D. degree from Columbia University in 1909 under the direction of Dr. Marston T. Bogert. An honorary Sc.D. was conferred on him in 1932 by Lawrence College.

Dr. Gortner came to the University of Minnesota in 1914 as associate professor in the Division of Soils from the Station for Experimental Evolution at Cold Spring Harbor, N. Y. It was during the period at the Carnegie station that Dr. Gortner formed his close personal and scientific association with the late Dr. J. Arthur Harris, who probably exerted more influence on Dr. Gortner's scientific thinking than any other one person. This association culminated in Dr. Gortner being largely instrumental in bringing Dr. Harris to the University of Minnesota as head of the department of botany.

Dr. Gortner transferred to the Division of Biochemistry of the University of Minnesota in 1916 as associate professor and was made full professor and chief of that division in 1917, which position he held at his death.

Dr. Gortner's contributions to scientific journals number more than 300. His scientific interests were very broad. This became evident very early in his career. His first interests were chiefly in the field of organic chemistry, his first publications in 1905 and 1906, while still an undergraduate student, being in this field, as was his doctoral dissertation. However, he became interested in the field of colloid chemistry as early as 1908 in connection with a study of the reaction between chromic and hydriodic acids, published in the *Journal of Physical Chemistry*, and he was publishing papers in the fields of plant and animal biochemistry shortly after he joined the staff of the Station at Cold Spring Harbor. It was here, also, that Dr. Gortner began his application of physical chemistry to biochemical phenomena which dominated a large part of his work and that of his students in later years.

The enumeration of the many scientific subjects on which Dr. Gortner published would cover several printed pages. The fields of work in which a series of papers appeared is, in itself, a formidable one and includes the following: (1) melanin; (2) the chemistry of embryonic growth; (3) physicochemical properties of vegetable saps; (4) the humin fraction in protein hydrolysates; (5) the organic matter of soil; (6) the chemical and colloidal properties of flour proteins; (7) sulfur in proteins; (8) physicochemical studies on proteins; (9) electrokinetics of colloidal systems; (10) interfacial energy and the molecular structure of organic compounds; (11) the role of water in living processes; (12) the chemistry of wood and of the pulping process. So varied were Dr. Gortner's interests that his influence was felt in the research of almost every field of agricultural science and in the investigations of the entire department of agriculture of the university. This influence extended outside of these circles into other colleges of the university and throughout the nation. For many years he carried on an extensive correspondence with research workers in his special fields in the United States and also in foreign countries.

One of Dr. Gortner's major contributions to scientific thought was his book "Outlines of Biochemistry," the second edition of which appeared in 1938. Another volume, "Selected Topics in Colloid Chemistry," contained the lectures which he gave at Cornell University in 1935–36 in connection with the George Fisher Baker lectureship which he held, and a third volume prepared by Gortner and colleagues in 1936, entitled "J. Arthur Harris, Botanist and Biometrician," was in honor of his close friend. He also contributed chapters to several comprehensive monographs.

Dr. Gortner felt that his chief contribution to science was through his students. In recent years he delivered to many audiences his lecture on "Scientific Genealogy." His intense enthusiasm for science and especially for the field of biochemistry, his exceptional fund of scientific knowledge in many fields and his easy, familiar delivery made him an inspiring teacher. An increasing number of students were attracted to his classes and to his department for graduate work. He gave freely and liberally of his time and thought to the research problems of his own graduate students as well as to those of his colleagues both in the Division of Biochemistry and in other divisions of the university; in the early days of the development of graduate work in the Division of Biochemistry he spent many hours in the laboratory working with his students. During the 25 years of his service as chief of the division, 87 students were personally directed by Dr. Gortner in their graduate research, and during the academic years 1940–42 between 60 and 70 graduate students were in residence in the division. Dr. Gortner was active in many graduate student activities outside scholastic work. For five years he was national president of Phi Lambda Upsilon, honorary chemical fraternity, and for a number of years was "god-father" of the honorary graduate scientific society, Gamma Alpha, at the University of Minnesota.

A testimonial dinner had been planned for Dr. Gortner for Friday, October 2, in honor of the twenty-fifth anniversary of his appointment as chief of the Division of Biochemistry, at which time he was to have been presented with a bound volume of more than 200 letters from those who had been associated with him as colleagues and graduate students in the division during the 25 years. The hand of fate prevented him from seeing this volume. Instead it was with heavy spirits that his colleagues and students bore his remains to their final resting place on the day when the testimonial dinner had been set.

Dr. Gortner was honored by his colleagues with appointment to many positions of responsibility in scientific research and education. In the National Research Council he was serving at his death on committees on Biochemical Nomenclature, Chemistry of Proteins, Colloid Science and Organic Chemical Nomenclature; for the American Society of Biological Chemists and the American Chemical Society he was a member of the committee on Organic Chemical Nomenclature. For three years Dr. Gortner served on the executive committee of Sigma Xi, national honorary scientific society, and on December 31, 1941, he was elevated to the position of president of the society. Last May he was awarded the Osborne Medal

by the American Association of Cereal Chemists, given by this society to scientists who have made outstanding contributions in the field of cereal chemistry.

Dr. Gortner was a scientist whose mind had no racial or international boundaries. He was especially sympathetic towards the work of scientists laboring under adverse conditions. His intensely vital personality was evidenced in the enthusiasm with which he read in every field of thought, in the keen pleasure he took in scientific debate, in his passion for photographing in color a beautiful sunset at his lake cottage, and in his hearty laugh, his pride in his family and his division and in his loyalty to those whom he loved and admired. Those who in turn loved and admired him can not understand the necessity for his removal. Science in general will miss him sorely.

L. S. PALMER

UNIVERSITY OF MINNESOTA

RECENT DEATHS

DR. SIGISMUND SCHULZ GOLDWATER, commissioner of hospitals of New York City from 1934 to 1940, an authority on the construction and administration of hospitals, died on October 23 at the age of sixty-nine years.

PROFESSOR ROBERT WILCOX SAYLES, since 1907 curator of the Geologic Museum of Harvard University, died on October 23. He was sixty-four years old.

DR. ALBERT HASSALL, bibliographer and formerly assistant chief of the Zoological Division, U. S. Bureau of Animal Industry, died on September 18 at the age of eighty-one years.

DR. GEORGE GERALD HENDERSON, emeritus professor of chemistry of the University of Glasgow, died on September 28 at the age of eighty years.

SCIENTIFIC EVENTS

THE JAMES F. LINCOLN ARC WELDING FOUNDATION

THE James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, for two and a half years has been carrying on its second industrial study on arc welding, for which 408 awards amounting to $200,000 have been made.

Results of the study show that the war industries have only begun to gain the benefits of modern arc welding; that further application of the welding process will cut expenses by hundreds of millions of dollars from the United Nations' war bill and will cut by 30 per cent. the time required to produce ships and planes. Arc welding will save an average of 300 pounds out of every ton of steel going into war production.

Papers were submitted from 46 of the 48 states, by engineers, designers, architects, maintenance men and executives throughout the industrial field. Altogether, 408 awards were made to 458 recipients. The studies for which the awards were made, according to a letter from Dr. E. E. Dreese, head of the department of engineering of the Ohio State University, chairman of the Jury of Award, indicated that

the figures, based on representative products and structures, show a possible annual cost saving of $1,825,000,000. This includes 7,000,000 tons of steel valued at $271,000,000 and 153,000,000 man-hours of labor. This $271,000,000 is a conservative figure calculated at base prices of $34 per ton for billets and slabs and $42 for plate.

One representative study in the Progress Program reported that caissons under construction and projected for naval drydocks can be built by arc welding in one third less time, at a saving of 9,000 tons of steel, $3,540,000 in cost, also allowing armor plating for bomb protection with no more steel tonnage than older construction.

Another study reported that arc welding of propeller blades alone would save the aircraft industry $50,000,000 annually.

Conservative estimates, based on the reports, indicate an annual saving of $100,000,000 in the vast machinery-manufacturing industry which is vital to our national security in war-time and indispensable to our way of life in times of peace.

Members of the Jury of Award were: Dr. Dreese, *chairman;* Assistant Professor R. W. Ahlquist, electrical engineering department, the Iowa State College; Associate Professor Paul Andersen, civil engineering department, the University of Minnesota; Professor Allison Butts, electrometallurgy department, Lehigh University; Professor R. L. Dowdell, metallography department, the University of Minnesota; R. G. Dukes, dean of the Graduate School, Purdue University; Professor Herbert B. Dwight, electrical engineering department, the Massachusetts Institute of Technology; Assistant Professor Fulton Holtby, foundry practice, the University of Minnesota; Professor C. A. Koepke, mechanical engineering department, the University of Minnesota; Professor Arthur F. Macconochie, mechanical engineering department, the University of Virginia; O. W. Muckenhirn, instructor of electrical engineering, the University of Minnesota; C. T. Morris, head of civil engineering, the Ohio State University; J. B. Taylor, head of the department of accounting, the Ohio State University; L. F. Van Hagan, chairman of the civil engineering department, the University of Wisconsin; Professor Chilton A. Wright, civil engineering department, Polytechnic Institute of Brooklyn.

The three principal awards were:

$13,700, First Grand Award, Captain C. A. Trexel and

A. Amirikian, director of planning and design and designing engineer, respectively, Bureau of Yards and Docks, Navy Department, Washington, D. C.: Caissons for naval dry docks. Net savings for arc-welded caissons built and under contract $1,652,000. Savings on projected construction in the immediate future $3,540,000. Savings in steel (projects built 4,200 tons) and (caissons projected) 9,000 *tons*.

$11,200, Second Grand Award, John L. Miller, chief metallurgist, Gun-Mount Division, The Firestone Tire and Rubber Company, Akron, Ohio: Welding the 40mm Bofors anti-aircraft gun and how various parts were changed from riveted to welded design. Cost per chassis, welded, was $76.80 less than riveted construction. The total saving with 35,000 units is estimated at $6,000,000.

$8,700, Third Grand Award, H. Thomasson, welding engineer, Canadian Westinghouse Company Limited, Hamilton, Ontario: A new type of large mercury-arc rectifier, called ignitron, which requires extremely high vacuum. On a number of items, an average of 47 per cent. was saved in cost by using arc welding instead of an alternate construction. This amounted to $63,000 per year for the company, which, at the same rate, would be $166,000 for the industry.

THE CONSERVATION OF FISHERIES IN THE GREAT LAKES

THE International Board of Inquiry of the United States and Canada which has studied for two years the conservation of fisheries in the Great Lakes, according to a special dispatch to *The New York Times*, recommended on October 20 that, based on the results of common studies of these fisheries, regulations for their management be formulated and tested by a joint agency of the two countries. The recommendations are as follows:

1. That there be common investigation of the fisheries of the Great Lakes.
2. That, in so far as investigation shows fisheries to be dependent upon a common stock or to have the same conditions, regulations for management of these fisheries be formulated and tested by a common or joint agency.
3. That where investigations are not conclusive such common regulations be applied and the results therefrom carefully determined until there is adequate proof of their effectiveness for the purpose.
4. That the attention of the agencies concerned be drawn to the need (a) for accurate statistics of the take and of the fishing effort, (b) for separate statistics for each species of fish and (c) for separate statistics for each of such districts as may be defined in common agreement.
5. That thorough tests be made of the effectiveness of planting fish in a lake or lakes in order to determine whether the present planting of fish should or should not be continued or altered.

In a supplemental report the United States members suggest a form of agreement which would vest control in established agencies in Canada and the United States, with regulation handled through the concurrent action of federal and state governments.

Members of the board were Herbert R. Gallagher, chairman, assistant director, Council of State Governments, Chicago; A. G. Huntsman, consulting director, Fisheries Research Board of Canada, Toronto; John Van Oosten, United States Fish and Wild Life Service, Ann Arbor, Mich., and D. J. Taylor, deputy minister, Game and Fisheries Department, Toronto.

The establishment of the board grew out of a series of interstate and international conferences during the past few years by the Council on State Governments for the conservation of the Great Lakes fisheries. The problem of conserving the fisheries had also long engaged the attention of the Governments of Canada and the United States, the Province of Ontario and the States bordering on the Great Lakes. The production of some species of Great Lakes fish had reached low levels.

BIOLOGICAL ABSTRACTS

Biological Abstracts announces the establishment of a seventh section, which will be devoted to "Specially Assembled Abstracts of Food and Nutrition Research" to be initiated in January, 1943. This section will consist of an assembly and reprinting of all abstracts that deal with human and animal nutrition and metabolism, vitamins, diet and diet-deficiency diseases, food composition and values, food processing and food microbiology, beverages, storage and conservation of foods, food spoilage, in short, all biological literature that pertains to foods and nutrition.

Biological Abstracts has covered this literature ever since its establishment in 1926. In previous volumes abstracts pertaining to foods and nutrition have been dispersed throughout the entire volume, hence those whose special interests lay in the foods-nutrition field were able to obtain them only through the purchase of the five original sections. The segregation of the foods and nutrition abstracts in the new section will provide an abstracting service at greatly reduced cost.

Every possible effort is being made to cover the literature completely. Efforts to obtain abstracts of publications from continental Europe, now mostly unavailable to workers in this country, are continuing. In spite of the restrictions affecting the diffusion of research information occasioned by the war more than 1,700 periodicals in the biological field are being abstracted. The new section will therefore from the beginning afford practically a complete survey of the literature.

Each volume will consist of ten issues; subscribers will receive the index to the complete edition of *Biological Abstracts*. Inquiries should be addressed to *Biological Abstracts*, University of Pennsylvania, Philadelphia, Pa.

TROPICAL MEDICINE AT TULANE UNIVERSITY

It is reported in the *Journal* of the American Medical Association that twelve Latin American physicians joined the course in tropical medicine at Tulane University of Louisiana School of Medicine, New Orleans, in September under fellowships financed by the American Foundation for Tropical Medicine. They are Drs. M. Sanchez Basseres, Brazil; M. A. Cardenas, Chile; Benjamin Mera, Colombia; Alejandro Gonzalez L., Costa Rica; Gilberto Gomez R., Dominican Republic; Alfonso Marchan, Ecuador; Jose Pacas M., El Salvador; Jose Bustos, Mexico; Silvestre Lopez Portillo, Mexico; Carlos Calera M., Panama; Jorge Clavier, Venezuela, and Tulio Briceno, Venezuela. Dr. L. Everard Napier, director of the Calcutta School of Tropical Medicine and editor of the *Indian Medical Gazette,* recently accepted a visiting professorship in the department of tropical medicine and is expected to join the staff early in 1943. During the past spring and early summer the staff gave intensive night courses in tropical medicine to physicians in the military forces stationed in New Orleans. Dr. Ernest C. Faust, head of the division and director of laboratories of tropical medicine and consultant to the Secretary of War on tropical diseases and on epidemic diseases, lectures every two months at the Army Medical School, Washington. Drs. Faust and Joseph S. D'Antoni, assistant professor in the department, are collaborating with the division of medical sciences of the National Research Council in lecturing on tropical medicine at medical schools in the East and North during October and November. In 1941 the General Education Board of the Rockefeller Foundation gave \$200,000 to enlarge the personnel of the department and to plan for a more permanent teaching program for undergraduate and postgraduate work in the field. Since 1940 the American Foundation for Tropical Medicine has provided an annual sum of \$9,000 for postgraduate teaching, particularly for a special intensive course for Latin American physicians. This year two fellowship grants have been made available for North American physicians by the Lambert Pharmacal Company, St. Louis, and the Winthrop Chemical Company, New York. Since 1940 the Eli Lilly Company has provided a yearly grant of \$5,000 for unrestricted research carried out under the auspices of the department. Under the program the physician receives intensive training both in laboratory and in clinical tropical medicine in addition to review work in the general field of medicine; additional training is provided by special guest lecturers who are experts in their respective fields.

THE NATIONAL CHEMICAL EXPOSITION

The National Chemical Exposition and Industrial Chemical Conference, the second to be sponsored by the Chicago Section of the American Chemical Society, will be held from November 24 to 29 in the Hotel Sherman, Chicago.

Professor G. L. Clark, of the department of chemistry of the University of Illinois, is chairman of a committee which has arranged for a symposium of electron microscopists. Preceding the symposium there will be an address on Thursday evening, November 26, by Dr. W. K. Zworykin, associate director of the Research Laboratories of the RCA Manufacturing Company, at Camden, N. J., on "The Electron Microscope in Relation to Chemical Research." In addition to a display of one of the microscopes in operation, a hundred or more photographic prints of some of the best micrographs will be exhibited.

A group of members of the Chicago Section has been working with S. Donald Perlman, executive chemical director of the salvage section of the War Production Board, in planning an exhibit to further its campaign to salvage essential chemicals.

Special exhibits will illustrate what has been accomplished in providing substitutes and alternates for critical materials in which there is a shortage. A display is being prepared by Dr. Harrison E. Howe, of "Successful Alternates and Substitutes." W. J. Murphy is arranging for an exhibit of "New Chemicals." The committee in charge of industrial movies has arranged for a continuous program.

More than a hundred exhibitors have been assigned space. The exhibit will be approximately twice as large in floor space as the first exposition in 1940. Originally set for the Stevens Hotel, a shift to the Hotel Sherman was necessitated by the acquisition of the Stevens by the U. S. Army.

Technical sessions have been arranged for Wednesday afternoon, November 25; Thursday evening, November 26; Friday morning, afternoon and evening, November 27, and Saturday afternoon, November 28. The program is timed to afford those who wish to hear the discussions in which they are interested ample opportunity also to view the exhibit.

THE AMERICAN MATHEMATICAL SOCIETY

The three hundred and ninety-first meeting of the American Mathematical Society will be held at the University of Notre Dame on November 27 and 28, in connection with the centennial celebration of the university. Sessions for the reading of contributed papers will be held on Friday afternoon and Saturday morning. In connection with this meeting, the University of Notre Dame will hold its annual Mathematical Symposium, the subject being "Modern Statistics." At this symposium, Professors Jerzy Neyman, of the University of California, and Abraham

Wald, of Columbia University, will each give two lectures. The titles of the lectures by Professor Neyman are "Theory of Confidence Intervals" and "On a Class of Tests Equivalent in the Limit to the Likelihood Ratio Tests," and of Professor Wald are "Outline of a General Theory of Statistical Inference" and "Asymptotic Properties of the Likelihood Ratio Tests."

The previous meeting of the society was held in New York City on October 30 and 31. On Friday morning, members were invited to attend a symposium of the Optical Society of America of invited papers on "Optical Instruments." In the afternoon, there was a symposium with the Optical Society of America on "Mathematics in the Field of Optics," with addresses by Professor J. L. Synge, of the University of Toronto; Dr. S. Q. Duntley, of the Massachusetts Institute of Technology; Dr. R. C. Jones, of the Bell Telephone Laboratories, and Professor Parry Moon, of the Massachusetts Institute of Technology. On Saturday, the sessions for contributed papers were held at Columbia University. In the afternoon, Professor Salomon Bochner, of Princeton University, delivered an address, by invitation of the program committee, on "Continuation of Analytic Functions in Several Variables."

SCIENTIFIC NOTES AND NEWS

A SYMPOSIUM on "The Physical and Chemical Organization of the Cytoplasm" will be held at the University of Chicago on November 13 in celebration of the seventy-fifth birthday of Professor R. R. Bensley. During the past ten years Dr. Bensley has separated a number of cytoplasmic constituents from the cytoplasm and subjected them to chemical analysis. He was for over thirty years director of the Hull Laboratory of Anatomy at the University of Chicago, and these pioneering studies on cytoplasm have been made in the ten years since his retirement.

AT the Richmond meeting of the Southern Medical Association, held on November 10, 11 and 12, the research medal of the association will be presented to Dr. Perrin H. Long, professor of preventive medicine at the Johns Hopkins University School of Medicine, "in recognition of his outstanding contributions to the knowledge of bacteriology and chemotherapy."

DR. C. VICTOR VIGNES, dean emeritus of the School of Dentistry of Loyola University, was honored recently by the dentists of New Orleans with a formal dinner in recognition of his fifty years of service to dental education and to the dental profession.

DR. WALTER H. SNELL, chairman of the department of botany of Brown University, has been appointed Stephen T. Olney professor of botany.

PROFESSOR W. LAWRENCE FAITH, of the Kansas State College, Manhattan, has been appointed professor of chemical engineering and head of the department at the State University of Iowa.

ALFRED TARSKI, the Polish mathematician and logician, formerly of the University of Warsaw, has joined the faculty of the University of California at Berkeley for the duration of the war. Dr. Tarski holds a Guggenheim fellowship, but prefers a post where he can continue teaching. He came to the United States in 1939 to attend a mathematical congress and to lecture at Harvard University. War conditions made it impossible for him to return to Poland. He has therefore decided to become a citizen of this country.

DR. WILLIAM CROCKER, managing director of the Boyce Thompson Institute for Plant Research, Inc., Yonkers, N. Y., will spend the winter quarter, from January to March, 1943, at the University of Washington, as Walker-Ames visiting professor. He will give a series of ten lectures on "Special Chapters in Plant Physiology," dealing with several projects developed at the institute during the last eighteen years. He will also give several popular lectures and conduct a seminar in botany.

DR. MATILDA M. BROOKS, research associate in biology at the University of California at Berkeley, has received the Grace Lavayea Fellowship of the Kappa Alpha Theta National Fraternity for the year 1942–1943, and also a grant-in-aid for research from the same source.

DR. R. ADAMS DUTCHER, head of the department of agricultural and biological chemistry at the Pennsylvania State College, has been appointed a member of a sub-committee of the Food and Nutrition Board of the National Research Council.

DR. E. R. GILLILAND, professor of chemical engineering at the Massachusetts Institute of Technology, and Ray P. Dinsmore, of the Goodyear Tire and Rubber Company, Akron, Ohio, are among the consultants appointed by the rubber director, William M. Jeffers, to study the technical aspects of the program.

DR. NED H. DEARBORN, dean of the division of general education of New York University, has been named executive vice-president and managing director of the National Safety Council, succeeding W. H. Cameron, who is retiring after serving for almost thirty years as managing director. Dr. Dearborn will

direct the greatly expanded war-time program now being conducted by the council.

DR. EDWARD S. ROGERS, acting assistant commissioner for medical administration of the New York State Department of Health, Albany, has been appointed director of the Office of War Nutrition Service of the New York State War Council. He will direct the work of all the departments and agencies that are concerned with problems related to nutrition. Dr. Alvin A. Florin, Woodmere, assistant district health officer, has been appointed assistant to Dr. Rogers.

DR. C. H. GRAVES, assistant professor of mathematics at the Pennsylvania State College, has leave of absence to enable him to serve as associate educational statistician in the Federal Security Agency, Office of Education, Washington, D. C.

DR. D. K. TRESSLER, head of the division of chemistry of the New York State Agricultural Experiment Station at Geneva, has presented his resignation, effective in January, to accept a position with the General Electric Company at Bridgeport, Conn. He will conduct research in the field of food refrigeration.

DR. FRANK E. EGLER, assistant professor of forest botany at the New York State College of Forestry, Syracuse, N. Y., has been appointed the first director of the newly established Experiment Station of the Chicle Development Company, with business offices at 500 Fifth Avenue, New York, N. Y., and field headquarters at Honey Camp, British Honduras, Central America. The Chicle Development Company is the Latin American subsidiary of the Beech-Nut Packing Company and the American Chicle Company. Dr. Egler maintains his affiliation with the New York State College of Forestry.

DR. M. DON CLAWSON, director of dental education at Meharry Medical College, who has served twelve years in the Near East, has been placed at the head of a mission to the Near East sponsored by the American Dental Association. The commission will make a survey in that area of the dental needs of the United Nations.

DR. ERNEST CARROLL FAUST, president of the American Society of Tropical Medicine, which meets at Richmond conjointly with the Southern Medical Association, will deliver the presidential address at the luncheon of the society on November 11. He will speak on "Horizons of American Tropical Medicine." The address of Dr. Herbert C. Clark, president of the American Academy of Tropical Medicine, will be given in the evening at the dinner of the academy. His subject will be "Some Impressions of Medical Practice in the Tropics."

THE third Alvarenga Prize Lecture was delivered before the College of Physicians of Philadelphia and the Philadelphia County Medical Society on October 14 by Dr. Edwin J. Cohn, professor of biologic chemistry and head of the department of the Harvard Medical School. His subject was "The Plasma Proteins: Their Properties and Functions."

DR. J. C. DRUMMOND, scientific adviser to the British Ministry of Food, delivered the Harben Lectures for 1942 at the Royal Institute of Public Health and Hygiene, London, on October 26, 27 and 28. His subject was "Problems of War-time Nutrition."

DR. R. M. TAYLOR, of the Rockefeller Foundation and the head of the virus department of the National Department of Hygiene, recently lectured on influenza at the Academia Nacional de Medicina of Buenos Aires.

BECAUSE of the war and the attendant difficulties, bringing increased burdens upon the membership of the Mineralogical Society of America, together with the difficulties of travel and arranging accommodations, the council of the society has voted to cancel the meeting originally scheduled for Ottawa from December 29 to 31. Abstracts of papers to be published will be received as usual, but publication of the official program for the annual meeting will be omitted this year. Abstracts submitted will be published in the March issue of the *Journal*, together with the report on the affairs of the society for 1942.

THE dedication of the Mineral Industries Building of West Virginia University was attended by five hundred delegates and visitors from the state and from neighboring states. The first day, October 16, was devoted to registration and general meetings and the second to divisional meetings.

THE industrial chemical investigations of the Regional Soybean Industrial Products Laboratory of the U. S. Department of Agriculture have been transferred from the University of Illinois to the Northern Regional Research Laboratory at Peoria, leaving at the university only an agronomic laboratory and oil, meal, engineering and analytical units. Dr. T. H. Hopper, director of the laboratory, has been appointed chief of the analytical and physical chemical division of the Southern Regional Research Laboratory at New Orleans.

THE Committee on Public Health Relations of the New York Academy of Medicine has made a report on oxygen therapy, a method of treatment which is growing in importance and in scope of application. It urges in eight recommendations that certain standards and regulations be adopted on the medical procedures to be followed and on the equipment to be used.

THE Parmly Foundation for research in hearing has been established at the Illinois Institute of Technology with an endowment of $300,000 by the late Samuel P. Parmly, Jr., who, though deaf, was a successful and well-known Chicago business man. The foundation will concentrate on the physics of hearing and will cooperate with the medical profession in studying other aspects of the problem involved.

ACCORDING to an announcement appearing in the daily press, the Swedish-American News Exchange was informed on October 16 from Stockholm that the Nobel Prizes would not be awarded this year. The prizes have not been awarded since 1939.

THE American Standards Association recently announced approval as American standards of twenty-three standards and specifications developed by the American Society for Testing Materials. All are of considerable interest to manufacturers and purchasers in the mechanical industries. Seven deal with wrought-iron and wrought-steel pipe and tubing; twelve cover specifications for testing materials for boilers, pressure vessels, flanges and boltings, locomotives, etc.; two cover malleable iron castings and cupola malleable iron and two deal with fabricated steel bars and welded steel wire fabric for concrete reinforcing. These twelve specifications cover materials for boilers, pressure vessels, flanges, locomotives, etc.

DISCUSSION

DEFORMATION OF ROCK STRATA BY EXPLOSIONS

THE greatest natural explosions produced on earth are due to the fall of giant meteorites and to volcanic explosions. Those of the first sort produce meteorite craters, those of the second calderas. Craters of both origins may be so nearly alike that surface configuration offers no sure criterion for their differentiation. Effects of the two types of explosions on the bed-rock are however quite unlike. Meteoric explosions may produce intense deformation in rock layers beneath and adjacent to craters; volcanic explosions produce little or no such deformation.

Examples to support this are found not far apart in Arizona. The famous "Meteor Crater," 4,000 feet across and 600 feet deep, records the impact and explosion of a giant meteorite, fragments of which were blown by the thousands over the surrounding plains. Sedimentary rocks exposed in the walls of the crater are tilted radially away from the center, and variation in the dips around the periphery defines a bilateral structural symmetry.[1] The brecciated wall rocks are broken by radial faults.

Evidences for violent volcanic explosions attended by eruption of lava and fragmental materials are found in the Hopi Buttes area in northeastern Arizona.[2] Some of the calderas thus formed were the size of Meteor Crater. Many have been deeply eroded, so that the structure of the underlying and adjacent bed-rock is displayed. Hack, who has studied and mapped these features in admirable detail, states that in no example was the bed-rock deformed as a result of the explosions.

From comparison of meteorite craters with volcanic calderas, it may be concluded that sudden deformation of bed-rock by flexing and faulting is characteristic only of explosion craters of the first type.

No one knows by direct observation how a dissected meteorite crater might appear or what types of structures would be revealed by deep erosion. However, the excavations at Odessa Meteorite Crater in Texas have shown that the rim rocks are folded and faulted and that deformation is highly localized around the periphery.[3] Generalizing from this observation and from the fact that fractured rim rocks of meteorite craters are usually elevated so as to dip away from the center in all directions, the type of structure to be expected beneath a large meteorite crater would consist of a central dome flanked by folds and broken by faults and joints.

Structures of this general pattern have long been known, and it is highly improbable that some of them can ever be accounted for in terms of stresses originating within the earth. Examples are the Flynn Creek structure of Tennessee,[4] formed during the Paleozoic, the Sierra Madera dome of western Texas,[5] formed between Permian and Cretaceous time, and several of the domical structures that Bucher[6] has called "cryptovolcanic."

Presumably meteorites have been falling since the beginning of geologic time, and it would be strange indeed if the lithosphere did not somewhere bear the scars of their impact and explosion.[7] The structures

[1] D. M. Barringer, *Proc. Acad. Nat. Sci. Philadelphia*, 57: 861–866; 66: 556–565.

[2] J. T. Hack, *Bull. Geol. Soc. Am.*, 53: 335–372.

[3] E. H. Sellards and G. Evans, mimeographed circular dated September 1, 1941, *Bur. Econ. Geol.*, University of Texas.

[4] C. W. Wilson and K. E. Born, *Jour. Geol.*, 44: 815–835.

[5] P. B. King, *Univ. Texas Bull.*, 3038: 123–125.

[6] W. H. Bucher, Rept. 16th Internat. Geol. Cong., p. 1055–1083.

[7] J. D. Boon and C. C. Albritton, Jr., *Field and Lab.*, 5: 1–9, 53–64; 6: 44–64.

noted above and others like them are more likely to have been formed as a result of the lateral escape of earthly material in front of a downward plunging giant meteorite and the rebound that followed its impact.

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THE NON-UTILIZATION OF LACTIC ACID BY THE LACTATING MAMMARY GLAND

IT was first reported by Graham,[1] working with goats, that the lactating mammary gland utilized lactic acid. This was apparently confirmed by Shaw, Boyd and Petersen[2] on lactating cows. Both studies were based on the decrease in blood lactic acid in the passage of the blood through the mammary gland. More recently a criterion of the excitability of the animal was made available by the finding,[3] based on hemoglobin values, that any disturbance of the animal was invariably reflected in a considerable change in the concentration of the blood traversing the gland; whereas in the quiet animal there were little or no detectable blood concentration changes.

This report deals with a re-examination of the role of blood lactic acid in milk secretion based on arteriovenous differences of the lactic acid of blood in its passage through the mammary gland. Lactic acid was determined by a modification of the method of Barker and Summerson.[4] In 17 experiments in which the concentration of the blood traversing the mammary gland was less than 0.5 per cent. and the animals showed no apparent excitation, there was a mean arteriovenous lactic acid difference of only 0.52 mg. per cent. The standard error being 0.32, the difference is not significant. In 17 experiments, in which the blood concentration in the gland exceeded 0.5 per cent. and the animals were obviously excited, there was an apparent utilization of 2.4 mg. per cent. of lactic acid. The standard error of 0.70 demonstrates that this difference is highly significant and indicates that the reported utilization of lactic acid by the active gland was only an apparent utilization due to excitation.

The mean of the arterial lactic acid values of the animals in the excited group was 10.1 mg per cent.; whereas that of the quiet group was only 7.3 mg per cent. It is believed that the apparent utilization with excitation is due to a sudden concentration of lactic acid in the blood in which there is a diffusion of lactic acid into the glandular tissue, resulting in a temporary disproportion in the lactic acid concentration of the blood passing through the gland. This is further substantiated by experiments on both cows and goats under nembutal anesthesia. Arteriovenous samples drawn 10 to 15 minutes after placing the animals under anesthesia, at which time the blood lactic acid was still high due to excitation, showed an apparent utilization of from 2.6 to 7.7 mg per cent. of lactic acid. Samples drawn after the animals were under anesthesia 30 to 45 minutes, at which time the blood lactic acid approached normal, showed no utilization. It is concluded that the lactating mammary gland does not normally utilize blood lactic acid. A more extensive account of this work will be published soon.

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[1] W. R. Graham, Jr., *Jour. Biol. Chem.*, 122: 1, 1937.
[2] J. C. Shaw, W. L. Boyd and W. E. Petersen, *Proc. Soc. Biol. and Med.*, 38: 579, 1938.
[3] J. C. Shaw and W. E. Petersen, *Proc. Soc. Biol. and Med.*, 42: 520, 1939.
[4] S. B. Barker and W. H. Summerson, *Jour. Biol. Chem.*, 138: 535, 1941.

AN ENDORSEMENT OF THE USE OF GENERIC NAMES AS COMMON NOUNS

CERTAIN advantages in the use of generic names as common nouns, when the species is clearly understood, were discussed recently by Dr. S. O. Mast (SCIENCE, 96: 252, 1942); *e.g.*, the use of "some paramecia" instead of "some specimens of *Paramecium*" or "some *Paramecium*." The second phrase, as Dr. Mast points out, comes to be burdensome and repetitious; the third, as he explains, involves a grammatical error and a taxonomic invalidity, in that there is and can be only one "*Paramecium*," namely, the single protozoan genus *Paramecium*.

In spite of the advantages cited—economy of printed space, avoidance of burdensome phraseology and elimination of grammatical inaccuracies—some authors and editors are distinctly reluctant to use generic names as common nouns. As an extreme case of such reluctance I may mention a personal experience. A paper that I submitted to a British journal was adjudged unacceptable because of my use of the expressions "an amoeba" and "the amoebae." Only upon the capitalization of the initial letter of "amoeba" and "amoebae" was the paper accepted, although "amoeba," with plural "amoebae" or "amoebas," is recognized as a common noun in the Oxford Dictionary, and hence there is no need to capitalize it.

In my work on *Didinium* and other protozoan genera, I have consistently used the generic name as a common noun, preferring in the interest of brevity "ten didinia" to "ten specimens of *Didinium*," and in the interest of grammar the constructions "ten

didinia" and "the didinia were" to "ten *Didinium*" and "the *Didinium* were." Nevertheless, expressions identical in form to the last-mentioned two are to be found in current protozoological literature.

Actually, there is nothing new or radical in the use of generic names as common nouns. The practice is adequately supported by the authority that precedent invariably confers. For example, the following are some common animal names (hence common nouns) that are accepted in Webster's New International Dictionary, second edition: alligator, amoeba, arbacia, bison, hippopotamus, paramecium, rhinoceros and stentor. Yet each of these common names becomes a generic name when written with a capital initial letter and preferably italicized, though editorial practice varies with reference to italics; in other words, each is a generic name used as a common noun. In the plant world cases are even more numerous because of the wide popular interest in gardening and horticulture; *e.g.*, acacia, chrysanthemum, geranium, narcissus, rudbeckia and rhododendron. In the use of these and similar common names in scientific writings, it is merely necessary for the author to make clear what species is under consideration.

In view of the convenience which the practice embodies and the sanction which precedent has already conferred on it with reference to many of the more widely known animals and plants, there seems to be no logical reason for investigators and editors to look with disfavor on an author's judicious use of a generic name as a common noun.

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SCIENTIFIC BOOKS

APPLIED MATHEMATICS

Operational Methods in Applied Mathematics. By H. S. CARSLAW and J. C. JAEGER. Oxford: Clarendon Press. 1941.

THE title of this book might give a better indication of its contents if the words "Avoidance of" were prefixed thereto. For, the outstanding virtue of the book is that it dispels the mysticism formerly attached to the so-called operational calculus. After a brief introductory chapter tracing the historical development of the subject and giving due recognition to Heaviside, the real originator of the method, no further use of operators as such appears. Thus the book serves to put the subject on a firm basis in such a clear and simple way that even a student who is not too familiar with mathematics can learn the technique and understand the underlying theory.

The fundamental tool for the elimination of the operational method is the Laplace transform

$$x^*(p) = \int_0^\infty e^{-pt} x(t)\,dt,$$

which "carries" the function $x(t)$ into its "transform" $x^*(p)$. To solve an ordinary linear differential equation with constant coefficients in the unknown function $x(t)$ one transforms the equation by the above integral. Due to the fact that the transform of the derivative $x'(t)$ differs from $p\,x^*(p)$ by a constant (which is determined by the boundary conditions) the differential equation is transformed into an algebraic equation in $x^*(p)$. After solving this it remains only to discover the function $x(t)$ from its transform. In the first chapter this is done by use of a table of the simpler Laplace transforms. Verification of the validity of the process is left for a later chapter. Many examples and exercises are given so that the technique of the method can be thoroughly mastered.

After several applications to physical problems the authors return in Chapter IV to the theory behind the method. With a minimum of the theory of the Laplace integral and the elements of the calculus of residues they show that the method always gives a solution in the linear case described above. Partial differential equations are next treated. Here the Laplace transform serves to reduce the number of variables by one. Thus a differential equation in two independent variables becomes an ordinary equation after the transformation. For partial equations no general validity theorem is established, but each solution is verified directly. The remainder of the book consists of applications to heat conduction, hydrodynamics, various electrical, mechanical and wave problems.

The book strikes an excellent compromise between the rigor required in a mathematical text and the technical skill demanded by the engineering student. Ideals of precision are established by setting forth the foundations strictly. Then later verifications are left to the student who has caught the feeling for careful mathematical procedure. In this connection it might be in order to express regret that the difficult problem of the uniqueness of solutions is not at least mentioned. It is further to be deplored that in a book of this character there should be no mention of the Stieltjes integral. This integral is so obviously the correct tool for physical problems that it is difficult to understand why it has not found its way into physics texts. By its use the somewhat apologetic discussion of "impulsive functions" in Appendix III could be replaced by something less distasteful to the

mathematician. This is rather a comment on the existing dissemination of information about the Stieltjes integral rather than on the authors' choice of material. For there has been an evident effort in this work to meet the student of applied mathematics on his own ground.

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SOCIETIES AND MEETINGS

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS

Herewith is presented the eleventh annual report of the Pickering Memorial astronomer and the recorder of the American Association of Variable Star Observers. The past year, during most of which our own country has been involved in war, has, in spite of difficulties incidental to such conditions, been productive of results in the field of variable star observations and the studies of the variables themselves. With the decrease in time occupied in the routine care of the somewhat smaller number of observations which have been communicated, the recorder has been able to devote considerably more time to the long-planned statistical study of the variables—principally those of long period—which have for more than three decades been on the observing list of the association.

Not only have the reports from foreign observers been necessarily fewer and smaller, but our own observers have been fewer in number, as some of them have either joined the armed forces or have been engaged in other wartime activities.

Among those who are known to be actively participating in the armed services are Ensign C. B. Ford, formerly of Smith College; Private J. Russell Smith, formerly of Lubbock, Texas, and Captain A. T. Murphy, formerly of San Francisco, California. Foster D. Brunton, of Guam, is a prisoner of war, as is doubtless Father Depperman, in Manila.

The library continues to be used to some extent. Acquisitions during the past year numbered 168, including 43 volumes and parts of volumes, besides numerous reprints. Gifts of eleven books have been made by H. B. Webb, Anton Kovar, E. H. Jones and the recorder.

Slides: Again attention is called to the excellent collection of slides which is available for loan to members. It could be used much more extensively.

Telescopes: The three-inch telescope formerly owned by the late Sigmund K. Proctor has been donated by his mother, Mrs. Helene F. Proctor, as a memorial, and is now on loan to Mrs. Federer.

Publications: The *Bi-Monthly Bulletin* continues to serve a useful purpose. Three numbers of *Variable Comments* have been issued: one deals with the 1941 fall meeting, the report written by C. B. Ford; another contains the tenth annual report of the recorder; and the third covers the A.A.V.S.O. Get-together at New Haven in June, 1942, by Helen S. Federer.

"Variable Star Notes" appear regularly in *Popular Astronomy* and as a Harvard reprint at the end of the year. The original observations appear in the Harvard *Annals,* and Nos. 2, 3 and 4 of Volume 110 have been issued. Instead of containing the observations for each quarter separately, individual numbers now cover six months or more of observations.

Side Activities: It is to be regretted that activities other than the regular variable star observing program have not received the attention which was given them in former years. Doubtless the war can be blamed for much of the seeming neglect of these phases of our work. The Nova search has dropped considerably and the photographic research has been practically nil. The work of the occultations committee will be detailed by the chairman of that committee.

Professor Bobrovnikoff, of Perkins Observatory, Delaware, Ohio, hopes that members of the association will cooperate with him in the estimations of the brightness of comets. He has shown that some valuable cooperative work could be done by trained variable star observers. He is willing to give advice in this field of observing to all inquirers.

Research Problems: The hope expressed by the recorder in his tenth report, that he would be able to start on a real campaign of the discussion of the long-period variables, has been fully realized. During the past ten months he has discussed 250 variables. This has involved the handling of approximately 450,000 observations covering, in general, the past twenty years. The discussion has included not only new derivations of the mean light curves, but also the final determination of dates of maximum and minimum—about 12,500 dates—as well as the accumulation of an abundance of material for studying numerous correlations which pertain for the variables, especially the Me stars.

Results on a hundred of the variables have appeared in instalments of twenty-five each in *Variable Star Notes* for this year, together with diagrams of the light curves.

The SS Cygni and R Coronae Borealis stars have been well observed. SU Tauri dropped to a deep minimum, and RY Sagittarii to a shallow minimum, according to recent reports.

Annual Summary: Again, we must record a falling off in the number of observations received during the year, a total of 33,090 observations as against 37,443 for last year. Observations are meager for a few stars, especially the southern ones, but on the whole,

despite the smaller number of observations, the continuity of the light curves has been well maintained.

Cyrus F. Fernald, of Wilton, Maine, again heads the list, with a total of 4,206 observations. He observed on 143 nights, and reports having spent 207 actual hours at observing, an average of twenty stars per hour. This is a remarkable record, and well attests the value of having a finely mounted and properly adjusted telescope—an 8-inch Springfield reflector—combined with considerable experience and plenty of enthusiasm. How much time Mr. Fernald spends in listing his reports would be of interest.

In the 2,100 to 2,300 class are Holt, of Tucson, Ariz.; deKock, of South Africa; Cilley, of Lewisburg, W. Va.; and Peltier, of Delphos, Ohio. In the 1,100 to 1,800 class are Mrs. Kearons, and Messrs. Hartmann, Jones and Chandra.

Nine observers made between 500 and 1,000 estimates each, and eleven, between 200 and 500. These twenty-nine observers made 87 per cent. of all the observations, but the other 61 contributors, 13 per cent., have added materially to the cause.

Special mention should be made of the interest shown by our Canadian observers. We now have five active contributors from that country, with a total of 914 observations for the year. Our South African observers contributed 4,179 observations; from India came 1,602, and from Mexico, 952. Australia, Argentina and Japan contributed 372, 96 and 87, respectively. Our 74 American observers accumulated a total of 24,888 observations.

The eleven observers of the Milwaukee Astronomical Society contributed 1,518 observations; the three from the Fall River, Mass., group, 2,630; and the three in Portland, Maine, 431.

Personnel: Mrs. Helen S. Federer has acted as Pickering Memorial assistant throughout the year. She has acted as custodian of the records, plotting the observations and picking up discrepancies when they occurred. She has also looked after the correspondence and mailing out of *Bulletins*, *Annals* and so forth, thus allowing the recorder to spend much of his time on the discussion of the variables.

When the million mark will be attained is still a question, but to date the American Association of Variable Star Observers has reached a grand total of 880,000 observations in the 31 years since it began its work. We must not permit the variables to go unobserved, even in these war-torn times; an ever-continuing history of the activities of our variables must be maintained, in so far as it is possible. But first and foremost must come the winning of this war, and the sooner the better for civilization and for science.

LEON CAMPBELL

HARVARD COLLEGE OBSERVATORY

SPECIAL ARTICLES

PIMELIC ACID, BIOTIN AND CERTAIN FUNGI

EVIDENCE that pimelic acid is utilized by the diphtheria bacillus for the synthesis of biotin has been presented by du Vigneaud, Dittmer, Hague and Long.[1] Eakin and Eakin[2] report that the synthesis of biotin by *Aspergillus niger* was increased by the addition to the medium of pimelic acid, and the effect was enhanced by cysteine or cystine. However, du Vigneaud and associates found that pimelic acid did not replace biotin in its growth-stimulating effect on yeast. We have attempted without success to replace biotin with pimelic acid for thirteen fungi which suffer from a biotin deficiency.

The following organisms were used in one series of experiments: *Ceratostomella ips* #255, *C. ips* #438, *C. microspora*, *C. montium*, *C. obscura*, *C. penicillata*, *C. pini*, *C. radicicola*, *Grosmannia serpens*, *Fusarium avenaceum*, *Neurospora sitophila* 56.2 and *N. tetraspora* S_1. None of these fungi makes more than slight growth on a mineral-dextrose medium containing asparagine and purified agar unless biotin is present. The addition of 0.05 μ g of biotin to a tube containing 8 ml of the basal medium permits luxuriant growth.[3]

Negative results were obtained when the 0.05 μ g of biotin was replaced with 0.05 μ g of pimelic acid. No benefit was observed when the quantity of pimelic acid was increased to 0.1 μ g per tube containing 8 ml of medium.

Sulfur is furnished in our basal medium as $MgSO_4$. The medium used for the cultivation of the diphtheria bacillus contained *l*-cystine. Eakin and Eakin found that cysteine or cystine markedly increased the formation of biotin by *Aspergillus niger* in the presence of pimelic acid. However, none of the twelve fungi listed above grew when 0.1 μ g of pimelic acid and 1 mg of *l*-cystine, 0.1 μ g of pimelic acid and 1 mg of glutathione or 0.1 μ g of pimelic acid and 1 mg of methionine were added to the basal medium instead of biotin. Excellent growth was obtained when the pimelic acid in the above media was replaced by

[1] Vincent du Vigneaud, Karl Dittmer, Eleanor Hague and Barbara Long, SCIENCE, 96: 186, 187, 1942.

[2] Robert E. Eakin and Esther A. Eakin, SCIENCE, 96: 187, 188, 1942.

[3] Some of these fungi must be supplied also with thiamine or pyridoxine or with both vitamins in addition to biotin.

0.1 μ g of biotin methyl ester, which shows that the failure to grow in the tubes containing the pimelic acid was because the pimelic acid did not replace biotin, not because the medium was injurious; du Vigneaud and associates obtained maximum growth of the diphtheria bacillus under their experimental conditions with 1.5 μ g of pimelic acid, and a marked effect with 0.05 or 0.1 μ g. Eakin and Eakin, however, used as much as 1 mg of pimelic acid per culture, and report that 20 μ g per 12 ml culture gave maximum results. We obtained no growth from the addition per tube of the basal medium 0.1 mg of pimelic acid and 1 mg of *l*-cystine, or 1 mg of pimelic acid and 1 mg of cystine. Growth was obtained when 0.1 μ g of biotin was added to these media, demonstrating that lack of growth in the media containing pimelic acid was because of insufficient biotin, or physiologically equivalent substances, and not because of too much pimelic acid.

Ashbya (*Nematospora*) *gossypii*, the organism used by Kögl as a means of bioassay in the original isolation of biotin, was also tested.[4] Negative results were obtained when 1 μ g or 100 μ g of pimelic acid were added in place of biotin to 8 ml of a basal medium and when biotin was replaced with 1 μ g or 100 μ g of pimelic acid together with 1 mg of *l*-cystine. The results were negative also when the medium containing pimelic acid or pimelic acid and *l*-cystine was further supplemented with 1.5 mg of casein hydrolysate per tube.

It appears that the thirteen fungi we used are not able to synthesize biotin from pimelic acid, or from pimelic acid and *l*-cystine, under our experimental conditions. This should not be interpreted to mean that other organisms can not construct biotin from pimelic acid and *l*-cystine, nor that pimelic acid is not a precursor of biotin. The relation of microorganisms to thiamine and its thiazole and pyrimidine intermediates have demonstrated that some organisms have no synthetic power for thiamine and require it in molecular form; others have incomplete synthetic power and can construct the vitamin if furnished the proper intermediates, but not otherwise; while still others are able to make thiamine from the minerals and sugar in a basal medium. A somewhat similar situation may exist with regard to biotin. If it does, the fungi we have used appear to require biotin as such.

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[4] *Ashbya* was grown on a modification of the medium used by Kögl and Fries which contains thiamine and *i*-inositol.

THE RH FACTOR AND RACIAL ORIGINS[1]

In 1940 a new factor (Rh) in human blood was described[2] which is present in the blood cells of about 85 per cent. of white individuals (Rh-positive type). This blood property was found to be inherited as a simple mendelian dominant by a pair of allelic genes, *Rh* and *rh*.[3] Investigations on the distribution of the Rh factor among Negroes in New York City revealed a somewhat lower incidence of the Rh-negative type, while in full-blooded American Indians the Rh-negative type appears to be practically absent.[4] The extension of these studies to other races should yield results of significance from the standpoint of racial origins.

To account for the present distributions of the Rh factor in white individuals and in American Indians, a number of hypotheses could be considered, analogous to those proposed to explain the distribution of the four blood groups. Two main possibilities will be discussed: (1) That man was originally Rh-positive and that the present incidence of the Rh-negative type resulted from mutations from gene *Rh* to gene *rh*. While this might conceivably account for the exceptional occurrence of Rh-negative individuals among American Indians, to explain the higher incidence of the *rh* gene (almost 40 per cent.) in white individuals one would have to postulate an improbably high rate of mutation. (2) Another possibility is that there were originally two or more races, some predominately or exclusively Rh-positive, others Rh-negative, and that by crossing the present distribution of the Rh factor resulted.

Of significance with regard to this problem is the relationship that has been demonstrated by Levine *et al.* between the Rh factor and erythroblastosis foetalis, a disease responsible for a certain number of stillbirths and neonatal deaths.[5, 6, 7, 8, 9] In the typical case, the mother is Rh-negative, the father Rh-positive and the fetus Rh-positive, the latter having inherited the Rh factor from the father. Due presumably to some defect in the placenta, fetal blood es-

[1] From the Serological Laboratory of the Office of the Chief Medical Examiner of New York City. Aided by a grant from the Carnegie Foundation and the Committee on Human Heredity of the National Research Council.

[2] K. Landsteiner and A. S. Wiener, *Proc. Soc. Exp. Biol. and Med.*, 43: 223, 1940.

[3] K. Landsteiner and A. S. Wiener, *Jour. Exp. Med.*, 74: 309, 1941.

[4] K. Landsteiner, A. S. Wiener and G. A. Matson, *Jour. Exp. Med.*, 76: 73, 1942.

[5] P. Levine, E. M. Katzin and L. Burnham, *Jour. Am. Med. Assoc.*, 116: 825, 1941.

[6] P. Levine, P. Vogel, E. M. Katzin and L. Burnham, Science, 94: 371, 1941.

[7] P. Levine, L. Burnham, E. M. Katzin and P. Vogel, *Am. Jour. Obstet. and Gynec.*, 42: 925, 1941.

[8] L. Burnham, *Am. Jour. Obstet. and Gynec.*, 42: 389, 1941.

[9] A. S. Wiener, *Am. Jour. Clin. Path.*, 12: 302, 1942.

capes into the maternal circulation, and in susceptible individuals the production of anti-Rh isoantibodies results. These antibodies filter through the placenta into the fetus and destroy its blood cells and in that way give rise to the disease.

At first sight, one might conclude that since only Rh-positive babies are affected, this mechanism operates in a selective manner so as to eliminate the Rh-positive type. As a matter of fact, all the affected infants are heterozygous, genotype *Rhrh*, so that equal numbers of *Rh* and *rh* genes are lost every generation. The effect of the loss of these genes over a period of many generations on the distribution of the Rh factor is readily computed as follows:

Let us assume that we are dealing with a population of constant size containing x *Rh* genes and y *rh* genes. The initial distribution of the genes would then be as follows:

$$Rh_0 = \frac{x}{x+y} \qquad rh_0 = \frac{y}{x+y}$$

If the number of fetuses and newborn that die from erythroblastosis during one generation is c, then the distribution of the genes during the second generation would be:

$$Rh_1 = \frac{x-c}{x+y-2c} \qquad rh_1 = \frac{y-c}{x+y-2c}$$

Accordingly, if at the onset the number of *Rh* genes is equal to the number of *rh* genes, this process would have no effect on the relative distributions of the genes. If the incidence of the two genes is unequal, however, the less frequent gene would be affected to a greater extent than the more common gene, so that eventually, other things being equal, over a period of thousands of generations, the incidence of the former would be substantially reduced and it might even be practically eliminated.

These results offer further evidence against the mutation theory as an explanation of the present distribution of the Rh factor in white individuals. Even assuming a rate of mutation from *Rh* to *rh* (or *vice versa*) higher than any so far recorded for *Drosophila* and man, this selective action of isoimmunization against the less frequent gene would effectively prevent a population originally completely Rh-positive from attaining as high an incidence of the Rh-negative type as 15 per cent. On the other hand, if one assumes the existence of populations in the past (and possibly still surviving at the present time) consisting almost exclusively of Rh-negative individuals, then from crosses with other populations consisting largely of Rh-positive persons (like the American Indians) a hybrid population could result with a serological composition resembling that of the white individuals of New York City.

In conclusion, it should be mentioned that, as Haldane[10] and Wyman and Boyd[11] have pointed out, if we go back to Paleolithic times when man was presumably a rare animal, chance probably played a large part in modifying gene frequencies. In large populations, however, chance has only a negligible effect, so that at least during post-glacial times racial mixture must have been the most important factor influencing the frequencies of the genes *Rh* and *rh*.

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[10] J. B. S. Haldane, *Human Biology*, 12: 457, 1940.

[11] L. C. Wyman and W. C. Boyd, *Am. Anthrop.*, 37: 181, 1935.

VITAMIN A AND THE THYROID[1]

THERE is a theory that an antagonism exists between vitamin A and the thyroid. The evidence for this has been collected by Smith and Perman,[2] who have published evidence showing that in short experiments there is some counteraction of thyroxin by carotene. More recently Belasco and Murlin[3] in a somewhat similar experiment showed that vitamin A lowered the metabolic rate of hyperthyroid rats. No very logical reasons have been offered for such antagonism, if it exists, however, and close examination of results so far published reveal many discrepancies. It was felt, therefore, that further study was justified, and the following experiments were performed.

The sleeping metabolic rate was determined for 8 rats, 5 male and 3 female. After the range had been established, each rat was given 200,000 U. S. P. XI units of vitamin A[4] per kilogram daily by stomach tube. The concentrate was in oil solution, and contained negligible amounts of vitamin D. The volume of oil fed was between 0.2 cc and 0.6 cc daily. After 50 days of administration of the vitamin at this level (in one case after 34 days) desiccated thyroid powder, U. S. P. XI, was given in addition to the vitamin. The thyroid was given in amounts ranging from 0.25 to 0.35 gm per kilogram daily as a water suspension by stomach tube. The metabolic rate was determined at weekly intervals throughout. In no case did the vitamin A alone cause any significant alteration in the level of metabolic rate. When thyroid was fed in addition to the vitamin, the mean increase in metabolic rate was 25.5 per cent.

A second group of 4 rats, 3 females and 1 male, was given the same dose of thyroid powder after the range of metabolic rate had been determined. This dose caused a mean elevation of 58 per cent. in the metabolic rate. After this effect had been established, vitamin A was administered in addition to the thyroid,

[1] Part of the expenses of this investigation were borne by a grant from the Nutrition Research Laboratories.

[2] D. C. Smith and J. M. Perman, *Endocrinology*, 27: 110, 1940.

[3] I. J. Belasco and J. R. Murlin, *Jour. Nutr.*, 20: 577, 1940.

[4] Supplied by Atlantic Coast Fisheries.

and at the same level of dosage. Over periods of time ranging from 30 to 45 days from the beginning of vitamin administration there was no significant change in the metabolic rate, although there was a tendency to a lower level.

A third series of 6 rats, 4 males and 2 females, was thyroidectomized under ether anesthesia, and after recovery the level of metabolic rate was established. Vitamin A was fed to these animals at the same level as in the previous experiments. There was no significant change in metabolic rates over periods of time ranging from 45 to 60 days from the time vitamin A was started, although again there was some tendency to a lower level.

From these results it appears that the effects of vitamin A on the metabolic rate of rats, even in massive doses, are questionable.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

CONTROL OF BLUE MOLD OF TOBACCO BY A NEW SPRAY

Blue mold or downy mildew of tobacco (caused by the fungus *Peronospora tabacina*) is one of the most difficult of all fungous diseases to control with fungicidal spray materials. During the five years that mildew has been prevalent in Connecticut the writer has tested many spray materials. None of them have been satisfactory; some failed to stop the disease, some caused plant injury, some were too complicated of preparation and the farmers would not use them.

On the other hand, fumigation of the seed beds with benzol or paradichlorobenzene has given excellent control, if properly manipulated in seed beds which are tightly constructed so that too much of the gas will not leak out during the night. But improper use of either chemical involves certain risks of plant injury. Both are expensive if continued through several weeks.

There exists, therefore, a definite need for a simple, safe, inexpensive but effective spray or dust for controlling mildew in the beds. In quest of such a material the writer has tried a long list of chemicals but only within the last six months has he found one which seems to fill all these requirements. This material is ferric dimethyl dithiocarbamate (under the trade name of "Fermate"). It was first suggested to the writer as a possible mildew remedy by Mr. Harry F. Dietz, of the Grasselli Chemical Department of E. I. du Pont de Nemours and Company, and we are indebted to him for a supply of the chemical and much helpful information on its use.

The first experiments were conducted in the greenhouse during the past winter. All experimental plots were artificially inoculated with spores and, as a result, 100 per cent. of infection on untreated crocks was the rule. Usually 100 per cent. of the unsprayed plants die from the severity of the attack and, therefore, any fungicide which will preserve the treated plants under these conditions must have real merit.

During the winter four crops of plants—eight or ten 10-inch crocks of 200 to 300 plants each—were grown to size suitable for setting in the field and were either kept sprayed during this time with "Fermate" or left unsprayed as checks. The detail of these and later experiments will be published elsewhere.

All unsprayed plants became infected and most of them died. The most successful dosage of "Fermate" was 1½ to 2 grams in a liter of water with the addition of an equal amount of lime. When the plants were sprayed twice a week this treatment gave 95 to 100 per cent. of disease-free plants and they remained healthy until grown to transplanting size. At times there was a small amount of spray injury evidenced by chlorotic areas on the leaves, but this never caused serious detriment to growth and was lacking entirely in most of the trials.

In April of this year the experiments were repeated in the seed beds. The results fully substantiate those in the greenhouse in giving excellent control of mildew.

The results of these experiments, conducted during one winter in the greenhouse and one spring in the seed beds, appear quite encouraging and lead us to believe that we have at last found a successful, simple inexpensive prevention for tobacco mildew. Before drawing final conclusions, however, this treatment should be repeated over several seasons and by practical growers in different sections.

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AN ELECTRIC RECORDING MARKING COUNTER FOR THE CONSECUTIVE COUNTING OF SMALL OBJECTS

A new application of an electric counter has been devised for counting the projected cross sections of wool fibers. When magnified 500 times, the average diameter of wool fibers is seldom more than one inch and often is less than 0.5 inch. This counter shows possibilities of further applications in science and in-

dustry where materials of small surface area are to be counted and identified. While elaborate counting procedures involving ruled-glass plates or chambers have been applied on bacteria, blood and particle counts, they are not applicable to fiber counts.

Only recently has projection equipment for enlarging microscopic objects found wide application. Much of the eye fatigue associated with techniques involving direct scrutiny of objects through a microscope is eliminated. The problem of counting the images still remains and while it may be possible to count mentally the number of objects occurring within a projected area, a direct marking counting device may be profitably applied. To fulfil the need for a counter that will mark small objects, an electric recording counter was designed. The marking is accomplished with large soft lead pencil. The motion involved in the marking closes a small switch causing the current to pass through a coil. The magnetic field set-up moves a small laminated steel armature directly connected to an ordinary ratchet counter. A spring assembly quickly returns the counter in readiness for the next count. The counter-actuating assembly may be likened to a small electric motor whose rotary motion is limited to an arc of 45°, just sufficient to bring up the consecutive figures on the counter. A number of ratchet counters are suitable which add one unit for each oscillation of the shaft through approximately 45°. It was found desirable to select a counter without the return spring and supply an adjustable coil spring of greater tension. After experimenting with a number of different solenoids connected by means of a lever system to the counter, the above arrangement, which gives a rotary motion, was considered the best. The laminated core and the high inductance of the field coil makes the use of electric supply from ordinary A.C. line feasible. A three-foot flexible cord is desirable to connect the switch marking assembly with the electrically actuated counter, see Fig. 1.

Fig. 1 is the wiring diagram of the counting assembly. Probably the most vital factor in the proper operating of the counter is the selection of a suitable micro-type switch. There are a number of these switches which are now available on the market. An adjustable metal band holds the pencil in contact with the small plastic pin operating the switch and permits replacement or removal for resharpening. A very slight movement of the pencil causes the circuit to be closed. The silver contacts within the switch permit long continuous operation. It is important to choose a pencil that will mark with slight pressure. The quality of lead should not be any harder than a No. 2. Colored leads or waxes may be substituted for differentiating between materials being counted and for marking various types of surfaces.

Rapid counting and marking of a series of items are possible. It is easy, for example, to count and mark 150 fiber cross sections in one minute. Utilization of the electric counter has greatly speeded up wool fiber analysis by the count method outlined by

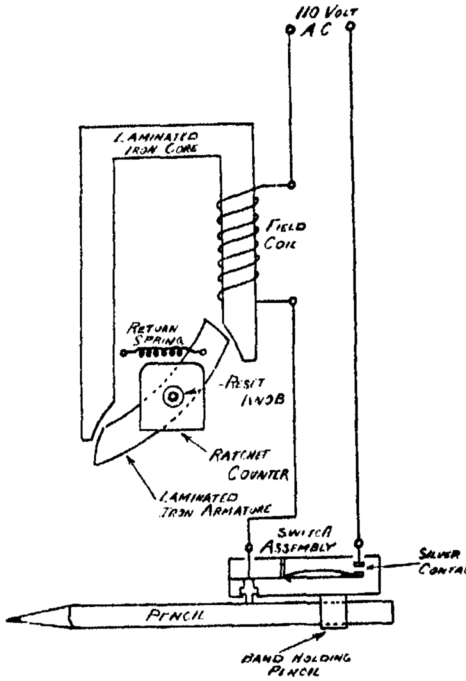

FIG. 1. Wiring diagram for electrical marking counter.

Hardy and Wolf[1]. This method consists in counting the number of wool-fiber cross sections included within a 125-square-centimeter area at a magnification of 500 diameters. Many applications could be mentioned, where advantages are possible by lessening the potential personal errors and speeding up tiresome routine procedures.

H. W. WOLF

[1] J. I. Hardy and H. W. Wolf, U. S. Department of Agriculture Circular 543, 16 pp., illus., 1939.

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SCIENCE NEWS

Science Service, Washington, D. C.

DANGERS CONNECTED WITH THE HANDLING OF METALS

A GRAPHIC description of the dangers connected with the handling of metals in American industry and the suggestion of an eight-point program to eliminate them were made by Dr. Robert A. Kehoe, of the University of Cincinnati College of Medicine, at the New Haven meeting on Industrial Health and Medicine in Wartime in the Yale School of Medicine.

"In a large measure this is a war of metals," said Dr. Kehoe, "and metals are being used increasingly for the weapons of war, the machinery to make those weapons and in chemicals for certain purposes. The toxicity of metals is not always well understood, but it is at least clear that some metals combine with the essential components of protoplasm, thus interfering with the workings of body cells. Some metals are poisonous because they form volatile chemical compounds which can be inhaled in high concentrations, notably arsine from arsenic. Others are poisonous because they are readily soluble in watery liquids and dissolve readily in the intestinal juices, becoming easily absorbed in the bloodstream. Again, a metal often occurs in combination with a more toxic substance and may be less hazardous than its partner—for examples, lead arsenate."

It was pointed out that once metals are inside the system, they are redistributed throughout the body in certain organs. Among these the liver is preeminent and in the case of more prolonged storage, the bony skeleton may become the most important storage depot. How long metals remain stored depends on a number of factors, including rates of breakdown of chemical compounds, rate of metabolic renewal of the tissue involved, and the form in which the poison occurs. Variations in the poisonous effect of metals depend on abnormally high concentrations, marked individual differences among men and the type of compound in which the metal occurs.

Dr. Kehoe outlined means of measuring the degree of exposures in terms of the toxic metal concentration, correlating those measurements with physiological effects and finding the established limits of safety. He said that exposure can be controlled with the following eight practices: (1) plant design to segregate more hazardous operations; (2) enclosed operations and properly designed equipment; (3) adequate ventilation with air-conditioning wherever possible; (4) housekeeping and maintenance; (5) protective equipment and sanitation; (6) instruction and regulations; (7) supervision of work and workmen; (8) general hygienic instruction of workmen.

DEHYDRATED FOODS

STRIDES in the dehydrated food industry were described recently by Dr. Samuel C. Prescott, dean emeritus of Massachusetts Institute of Technology, at the school conducted for operators, foremen, and plant managers by the Department of Agriculture at the Western Regional Research Laboratory.

"The War Department," he said, "has already purchased or contracted for nearly a hundred million pounds of dehydrated vegetables. Not only is this tremendous increase in the dehydration of foods a part of the war effort, but it is potentially a great and useful industry which will continue after the war."

The story of the development of dehydrating foods has been a history of emergencies. Dehydrated vegetables were first used in the Civil War when soup mixtures were given the troops to prevent scurvy. In 1886 a small plant to dehydrate vegetables was started in Australia to supply miners and explorers. About ten years later there was some interest in dehydrated foods in this country because of the needs of the miners in the Klondike gold rush.

During the Spanish-American War dehydrated potatoes were bought in considerable quantity for the navy. Soon after this the battleship *Oregon*, similarly supplied, made a trip around the world. "I saw some of the potatoes that went on that trip," Dr. Prescott said, "they were the color of a good brown derby."

In the Boer War troops sent to South Africa were supplied with dehydrated vegetables for soup mixtures. Some of these, packed in paraffined barrels, were kept until the World War and served to the British troops nearly fifteen years later.

In 1910 the United States had only a few kitchen-size dehydration plants. The World War gave a great impetus to the industry. The Navy, remembering the experience of the *Oregon*, refused to buy any considerable quantity of dehydrated vegetables, but the Army ordered many thousand tons. The products varied greatly in quality; some were good, others were "case-hardened," some scorched, and some not thoroughly dried. However the need was great and all were sent to France. This poor quality caused a prejudice against all dehydrated foods which retarded the further development of the industry. But some products were excellent even in 1919. At a dinner that year, served to 200 members of the American Society of Bacteriologists, no one was aware that the whole meal—with the exception of the roast, the rolls, and the ice cream—was prepared from dehydrated food.

In Germany the development far exceeded our own. Beginning with one small plant in 1898, we find 199 in 1909, and 1,900 in 1917 in which the total quantity of dried potatoes alone was equal to three times our annual crop.

During recent years and especially since 1940 under the stimulus of the Government Dehydration Committee, there has been a great increase in knowledge and interest. The best products—which include numerous varieties of vegetables—are practically equal to fresh ones in flavor, texture and nutrition.

The government hopes that by means of large scale inspection of plants, and by schools such as the Western Regional Research Laboratory, our fighting forces will be

supplied with the "best food they ever got in their lives" and also that a permanent industry will be established which will extend to and be of great value to all our people.

A NUTRITIOUS SOUP

THE latest addition to large-scale, low cost, high nourishment feeding is a three-cent soup mix announced by Dr. Robert S. Harris, of the Massachusetts Institute of Technology, at the Detroit meeting of the American Dietetic Association.

Made of skim milk powder, peanut flour, soya flour and peas, the soup mixture is inherently rich in good protein and in vitamins of the B complex. It will be possible to supplement it with minerals and with natural and synthetic vitamins so that each ounce can supply the full day's allowance of these diet essentials. A full day's portion can be supplied at a cost of two to three cents.

The mixture is ready to serve, so it is not subjected to the destructive effects of cooking. All the materials are available in large quantities which will make it possible for the soup to be used on a national or international scale. Used as a stock to which meat and vegetables may be added, it provides the possibility of great variety in a school-lunch menu.

A field study conducted in six schools in small communities in Michigan showed that the soup was palatable as 426 children consumed it daily for three months and showed no evidence of tiring of it. There were significant improvements in the group to which the soup was given in comparison with the control group who ate the usual school lunch. These improvements included a better ascorbic acid (vitamin C) and iron status and some improvement in weight and riboflavin status. The study showed that the hot school lunch previously supplied was not properly supplementing the home dietary.

SCARLET FEVER

THE most important factor in the making of a scarlet fever epidemic in any community is the condition of the environment and specifically the number of persons in the community carrying scarlet fever germs, according to a report made by Dr. Francis F. Schwentker and Dr. John H. Janney, of the Rockefeller Foundation, New York, to the St. Louis meeting of the American Public Health Association.

Over the world all the twenty-six serological types of germs belonging to the group A streptococci family have been isolated from patients with scarlet fever. In any single community, however, the sporadic cases are due to only a few types, and epidemic cases to only one type.

Strains capable of causing scarlet fever, called scarlatinogenic, are present sometimes in communities free from the disease, which raises the question, what causes an epidemic to start? The question is answered as follows:

"For scarlet fever to occur in a community, a scarlatinogenic strain of streptococcus must be present or introduced. The number of cases of infection which follow depends on the distribution factor as measured by the carrier rate. Low carrier rates mean only sporadic cases; high rates accompany epidemics.

"A part of the population are never reached by the streptococcus. These naturally remain well. Of the others who become infected, some have antibacterial immunity; they either eliminate the organism immediately or become healthy carriers.

"Those without antibacterial immunity become ill; the kind of illness is determined by the antitoxic immunity. If immune, the patient develops streptococcic tonsillitis; if not, scarlet fever. Other diseases such as erysipelas and puerperal fever may result with portals of entry other than the throat."

ITEMS

U. S. DEPARTMENT of Agriculture entomologists have discovered three ways to destroy the dog flies that menaced soldiers and construction workers at army camps in coastal areas. The methods are: spraying marine grass with dilute creosite oil; dipping celery waste, and burying peanut litter. The shoal and turtle grass on the shores of bays and sounds, the litter left after baling peanut vines for hay and the dump piles of waste strippings from celery washing plants all had previously been "fly factories." Dog flies do not carry disease to man, but their painful, stinging bites are enough of a nuisance to reduce efficiency 20 or 25 per cent., according to a statement made by the U. S. Department of Agriculture. Since the fly population has been reduced, contractors report increased efficiency of workers and estimate a savings at two camps alone of about $500,000. The dog fly is a serious pest to cattle. In 1939 owners of livestock in one coastal area reported that one fifth of their cattle died from loss of blood, hunger and weakness resulting from annoyance by this pest. In efforts to escape the flies, cattle rush into the mud and water of swamps, and become mired so that they are often unable to free themselves.

THE source of the petroleum from which industrial solvents, such as benzin, gasoline and solvent naphtha, are obtained plays a part in determining the possible injurious action of these chemicals on those who work with them. This is one part of the "lesson" Dr. W. F. Von Oettingen, principal industrial toxicologist for the U. S. Public Health Service, gave a group of fifty Connecticut physicians attending the opening class of the new course on "Industrial Health and Medicine in War Time" given at the Yale School of Medicine. The increasing use of hydrocarbons in war industries is creating new health hazards. The appraisal of these hydrocarbons offers considerable difficulties because most of these solvents represent mixtures, sometimes of heterogeneous nature, and because their composition is often only incompletely known. Certain solvents such as benzin, gasoline and solvent naphtha, may vary with regard to their chemical composition according to the source of the petroleum from which they are obtained and therefore vary also with respect to their injurious action. Dr. Von Oettingen suggested that the older method of describing these substances in terms of their physical properties failed adequately to indicate their potential injurious effects. Therefore, he suggests that appropriate chemical analysis be made in order to detect possible noxious components.

SCIENCE

VOL. 96 FRIDAY, NOVEMBER 6, 1942 No. 2497

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE ROLE OF SCIENCE INSTITUTIONS IN OUR CIVILIZATION[1]

By Dr. WILLIAM D. COOLIDGE

VICE-PRESIDENT AND DIRECTOR OF RESEARCH, GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Mr. President, Members of the Board of Directors of Ursinus College, Members of the Faculty, Members of the Student Body, Dr. Pfahler, Ladies and Gentlemen:

WE are met here to-day to dedicate this new temple of science—to dedicate it to the service of mankind and to give it a name—a name worthy of the inspiring tradition which shall with the years grow up around it.

In our evaluation of the importance of this event we are more in danger of under- than over-estimation. We can, of course, judge the future only by the past. So let us think of the consequences of similar occasions which have already taken place. To mention only a few examples drawn from the field of physical and chemical science:

Once upon a time there was doubtless a dedication ceremony for the physics institute of the University of Wurzburg, and it was in that laboratory that Roentgen later discovered the x-rays and published his results in a series of papers which have had so profound an influence on science and on our civilization. It is of course the man rather than the institution to whom we give most of the credit. The fact remains, however, that the institution attracted him and he was, perhaps unconsciously, inspired by its traditions.

In the same way consider the importance of the founding of the Royal Institution, where Faraday did

[1] Founders' Day address at the dedication of the Pfahler Hall of Science, Ursinus College, October 13.

his work on electromagnetic induction; and of the Albany Academy, where Joseph Henry made his great contributions in this same field. Our whole electrical industry is based on the work of these two men. Here again, although we give most of the credit to the men, as before, we can well question whether they would have had this same tremendous influence in our civilization had not others before them created and dedicated to science the laboratories in which their work was done.

Sometimes, as in the case of Madame Curie and her discovery and isolation of radium, we see the work done under such miserable physical conditions that we may well feel that it could have been done much easier somewhere else. The fact still remains, however, that the creation and the dedication of the institution in question were links in a chain without which the work would probably not have been done by the person and at the time period in question.

Countless other similar instances could be cited in which the dedication to the cause of science of a new laboratory or the creation of a new scientific society has constituted the beginning of a great tradition.

Over forty years ago, in the General Electric Company, a group of four men consisting of Elihu Thomson, E. W. Rice, C. P. Steinmetz and A. G. Davis, were so impressed by the consequences of the fundamental scientific work carried on in college laboratories that they started what was one of the first *industrial* research laboratories in this country—a step which has since been followed by some two thousand other manufacturing organizations.

I have been in close touch with the General Electric Research Laboratory from the beginning, and, since taking over its direction, I have been greatly impressed by the strength of the tradition which has grown up around it—a tradition derived from the great men who had the vision to start it and to sponsor it through its early years, and from Dr. Willis R. Whitney, who directed it throughout the formative period of its existence, who saw the value of cooperation and secured it, who saw to it that recognition was always given to the individual and not merely to the institution, who insisted that all worth-while results should be published promptly, instead of being kept secret in what had been the time-honored way. During my incumbency in this office I have been constantly aware of the force of that tradition—a force like that inherent in the momentum of a heavy and rapidly moving body. Had I been so disposed at any time, I would have found it very difficult to do anything which would have tended to weaken that virile and inspiring tradition.

Just as the tradition of our laboratory started with the characters and achievements of the men whose names were first associated with it, so the tradition of this laboratory starts with the characters and achievements of the men responsible for its existence and takes on to-day an intimate association with the life of the man whose name you have given it.

I feel competent to speak to you on the value of that name to the tradition of this laboratory.

It is the name of a great pioneer in the application of physical science to the diagnosis and treatment of human disease. It is the name of a man to whom countless sufferers from human ills owe their lives, their health and their happiness. It is the name of a man who has not only practiced and advanced an art, but who has greatly enriched the science underlying that art. It is the name of a man who has contributed not only to the practice but also to the teaching of that science and that art. It is the name of a man who has lived richly, enjoying not only his work but also his environment, traveling not only for his own pleasure at the time, but also that he might, through the photographic art and his patience and skill in the hand-coloring of his slides and movie films, share these artistic delights with his friends. From the personal standpoint let me add that he has for many years been to me an honored and respected friend and an inspiration. I have always felt grateful for the fortunate turn of events which resulted in my acquaintance with some of the great men in the medical profession, and high in my list of these stands the name of Dr. George E. Pfahler.

The science laboratory of to-day is the temple in which we come directly in contact with nature herself. Here to the patient, honest, reverent and open mind, she reveals herself, at least to the extent that the seeker after truth is capable of understanding her.

I think that the complex equipment which we are often forced to use in the laboratory, like the priest in the Ancient Oracle, stands somewhat between us and nature and diminishes the reverence which we would otherwise feel. After all the intervening years, fifty to be specific, one regular physics laboratory experiment at Massachusetts Institute of Technology stands out clearly in my memory because of the closeness of contact with nature which it seemed to give me. It was the experiment of the simple pendulum, in which the student takes a brass ball and measures its diameter and then attaches to it a string, of which he measures the length. Next he attaches the free end of the string to a rigid support and then with a watch determines the time of oscillation of this device as a pendulum. Simple calculation of the data gives the acceleration due to gravity, and from this and the gravitational constant, a quantity likewise obtainable in the laboratory, one may readily calculate the mass of the earth. The only equipment which I used was

the brass ball, some calipers, the string, the measuring stick and the watch; and still, with the gravitational constant known, it enabled me to weigh the earth.

You are to-day dedicating this laboratory to the cause of science, that is, the acquisition and teaching of knowledge relating to the physical world in which we find ourselves. Such knowledge contributes in so many ways to our happiness and our comfort.

The search for it would be worth while even if it did nothing more than satisfy the yearning of the human mind for knowledge of our environment.

We long to know the extent of the physical universe, how it came into being, the gross changes which it is undergoing and whither it is tending.

We have wondered how the stars, including our own sun, can be continually radiating such vast amounts of energy and still maintaining through the centuries such enormously high temperatures. Our own sun, for example, delivers energy to the earth at the rate of 2.5×10^{18} calories per minute. Now the world production of oil for 1939 was 2,100,000,000 barrels and the heating value of this is about 2.5×10^{17} calories. The energy which the earth receives from the sun in one minute is then ten times the heat of combustion of the entire 1939 world production of petroleum. And we are receiving but a tiny fraction, only about one two-billionth, of the total energy radiated from the sun. It is only within the last few years and through modern research on atomic structure, that we have been able to give even a plausible explanation of how this can continue.

We have wondered about our own earth, where it came from and how old it is. Spectroscopic observations made in the physics laboratory, coupled with similar observations made in the astronomical observatory, tell us that our earth is composed of the same chemical elements as those found in the sun. This and other evidence tells us that the earth was originally a part of the sun. The answer as to the age of the earth has also come from the science laboratory. The best of the various methods used is that based upon the radioactivity of uranium, an element which breaks down spontaneously into radium and this in turn into lead. (One hundred uranium atoms thus yield one lead atom in 66,000,000 years.) If then we determine the ratio of lead to uranium in uranium-bearing rocks, we have a simple measure of their age. In this way we arrive at an age for the earth of about two thousand million years.

We marvel at the myriad forms of animal and vegetable life and, still more, we marvel at the mystery of life itself. The science of biology by correlating the chromosomes and the genes and the mechanism of the reproductive processes goes far in explaining the variety of forms, but as yet has no explanation to offer concerning the life principle itself.

In my college days we talked of the atomic and molecular hypotheses. Since then, physical science has advanced so far that we are now able to count and weigh individual atoms and molecules. Not only this, but we are now able to break atoms up into still smaller particles—electrons, protons and neutrons.

These particles come from the nucleus, which has a diameter a hundred thousand times less than that of the atom itself. We ask ourselves how it is possible for the positive and negative charges of these protons and electrons to exist in such infinitesimally close proximity without mutual annihilation of charge. We ask ourselves, "What is the nature of the forces which bind these particles?" and the answer to this fundamental question may well have far-reaching consequences.

We wonder how the so-called virus diseases are propagated and what is a virus. Recent medical research, aided by such modern scientific tools as the ultra-centrifuge and the electron microscope, is now making real headway with this problem.

Prior to the time of Aristotle, such questions might all have been referred to the Delphic Oracle, but in the science laboratories we refer them to nature herself, changing experimental conditions until, without breaking her laws, she can give the answer.

Interest in our environment is all-embracing, including everything from the astronomical in size down to the smallest constituent of matter.

Many of our questions may never be answered, and it is probably well for our happiness that nature guards her secrets as closely as she does, since so much of our pleasure comes from our efforts to become better acquainted with her. To the superficial mind it may appear that we already know many of her secrets, but he who looks deeper sees that in many cases we have hardly done more than to give names to her manifestations.

It is as though each of nature's secrets were guarded by a combination lock which can be opened only after each of its many components has been put in its proper place. Consider, for example, the relation between the various chemical elements. It was found many years ago that they could be so arranged in groups in a table as to bring out a periodic recurrence of physical and chemical properties and that these were, with few exceptions, simply related to their atomic weights. The latter were in turn very nearly, but not quite, whole multiples of that of the lightest of the elements. The studies of J. J. Thomson and Aston with the mass spectrograph showed that each element was in general present in several isotopic forms differing slightly from one another in atomic weight. This brought us somewhat closer to an understanding of the relation between the elements, but the real answer came only through the chain of

events consisting of the discovery of the nature of the x-rays by Laue, the development of the x-ray spectrometer by the Braggs, and the measurement by Moseley, with the help of the spectrometer, of the wave-lengths of the characteristic x-radiations emitted by the various elements. With the help of this last information we were able to see that the various chemical elements were all made from the same building blocks and differed only in the number and arrangement of these blocks. The picking of this particular lock occupied a time period of many years, beginning with the work of Mendelejeff and ending with the work of Moseley and involving the efforts of many others. In this, as in perhaps every other case where an important physical principle has been discovered, success was due to the painstaking efforts of many men, each of whom built on the work of his predecessors.

Herein lies the importance of faithfully recording all scientific progress and making it readily available to those who may later build upon it. This has been conscientiously done for many years by many different peoples. Even as far back as perhaps 2000 B.C. the Cretans probably made an effort to do it. They wrote on clay tablets, which are still intact, but which we unfortunately are unable to read. They knew some astronomy, for they are famed as navigators, and tradition credits them with the ancient Minoan calendar. The Egyptians acknowledge their indebtedness to them for certain medical prescriptions, and the Greeks borrowed aromatic and medicinal herbs from them.

The present rapid progress in science is due in no small part to laboratories like this one, consecrated not only to the task of seeking new knowledge, but also to the handing on to successive generations of the knowledge of the past, not as a matter of dead history but as a springboard for further advances.

In this last connection we see marked differences in the quality and effect of science instruction, involving the attitude of both teacher and pupil. The teacher may present the subject either as a completed book or as a preface, and the student may either receive it as a finished work or question it even as a preface.

As a student in a German university many years ago, I saw the professor on a very high pedestal above the student. He came in, gave his lecture and went out, with no chance to question him at the time. In a Russian university more recently I saw something quite different—the professor clearly not on a pedestal but rather on the same level with the student, a condition much more conducive to a questioning attitude, without too much respect for authority, on the part of the student. Too much respect for authority is bad, as it can easily lead to the impression that the tree of science is full-grown—has reached its maturity—when as a matter of fact it's not only growing faster than ever but at an accelerating rate, for every new branch added to it gives rise to other branches and each of these in turn to more.

Authority derives from a generalization based on known facts, and the respect which it merits is then related to the number and significance of the supporting facts. It must not be forgotten, however, that it may always be upset by a single new fact. There was, for example, seemingly excellent authority for our earlier ideas on the conservation of mass and on the conservation of energy. This has been recently upset, however, by the discovery that mass and energy are mutually interchangeable.

To mention a much more common type of example from the field of magnetism: It seemed possible that an improved permanent magnet might result from cooling the constituent material through an elevated temperature range in a steady magnetic field. Such experiments made with various alloys showed no appreciable gain, however, indicating seemingly that magnetic domains in this type of material could not be usefully oriented in this manner. Too much respect for the authority built up on these experiments would have barred the progress which took place recently when further experimentation showed that a certain alloy differing but little in composition from those which had previously been submitted to the treatment in question was greatly improved by it, yielding a permanent magnet in most respects two to three times as good as the best of its predecessors.

The big steps in science have for the most part come from the work of fresh inquiring young minds—minds not overawed by the authority of their teachers—minds so young that experience hasn't yet taught them that new things can't be done.

I am glad to see that various sciences are to be housed together in this building instead of being widely segregated, for they are all parts of one whole, and the knowledge and the methods and the tools of each can be helpful to the others.

And these tools of which I speak play a tremendous role. To take for example a recent one, the cyclotron. Before its advent we had only a couple of radioactive materials—only those occurring in nature. To-day, thanks to the cyclotron, we have over three hundred artificially made radioactive elements. This has not only greatly increased our fundamental knowledge of matter, but has produced a battery of new tools in these various radioactive products themselves which can be used either as therapeutic agents or as tracers for the study of physiological processes, diffusion rates, chemical equilibria, and other purposes.

In the electrical field we have, among other modern tools, the vacuum tube amplifier which not only plays so important a role in radio and in the electrical art

generally, but in the medical field makes possible the portable electro-cardiograph and facilitates the demonstration and recording of electric currents generated in the human brain.

Another tool taken from the physics laboratory which has made valuable contributions in many ways is the ionization chamber. In the field to which Dr. Pfahler has devoted himself, it is now universally used to measure x-ray and gamma ray dosage. This has increased the effectiveness of radiation therapy and enabled specialists throughout the world to compare their results intelligently and to talk a common language in the field where previously confusion reigned.

Many other tools could, of course, be mentioned, each of which has contributed greatly to several different branches of science.

The tools of science serve to increase the range and scope of our senses, increasing our power of perception and making it possible for us not only to observe but also to record and measure physical phenomena.

The great Danish physicist, Niels Bohr, calls attention to the fact that each of our various senses has been developed to such a degree that further increase in sensitivity would be useless to us. Our scientific tools help our senses not so much by being more sensitive in the best working range of the latter but mainly by extending the range.

Consider, for example, the entire field of radiant energy extending from the long wave-length radio-waves down through heat and light to the shortest wave-length x-rays—a range of 60 octaves. Of this only one octave is perceivable by our unaided eyes. For our knowledge of the other 59 octaves we are dependent on such tools as the fluoroscope, the photographic film, the bolometer and the radio-receiving set. The eyes give us no direct information outside of a narrow band of wave-lengths, nor do they tell us anything concerning the distribution of energy in the spectral region with which they deal. For this information we are dependent upon the spectroscope and the thermopile or bolometer.

The light-gathering power of the lens of the eye is limited by its diameter. The 100-inch telescope gathers so much more light that it reveals to us nebulae two million times fainter than the faintest star just visible to our unaided eyes.

Through the optical microscope we have entered a whole new world of living and inanimate objects, and now the electron microscope gives us a further fifty-fold useful magnification. This last device is of too recent a vintage for us fully to appreciate its potentialities. But it is already opening our eyes to things which had never before been seen, as for example, the bacteriophages, those viruses which prey upon the various bacteria.

Our ears respond to sound vibrations through a range of about ten octaves. Our knowledge of sound vibrations outside this range has been greatly extended by the microphone and oscillograph and by the use of the local oscillator and the heterodyne principle. Such devices have also given us the quantitative information which our ears fail to supply. Our knowledge of mechanical vibrations taking place at remote points has also been greatly extended through the use of the microphone and the telephone receiver. This combination permits us to hear a fly walk on a distant object about as well as though he were walking on one of our eardrums, and likewise brings to us through a wire the conversation of a person who may be thousands of miles distant. In similar ways the other senses have been extended by the tools of science.

We are, of course, interested in science not only for the intellectual pleasure connected with its development and for its aid in amplifying and extending our senses and thus broadening our horizons, but also for the useful everyday applications which can be made of it. These last relieve us of drudgery, increase our bodily comfort and lengthen our span of life. While enjoying them we may occasionally sigh for "the good old days," but few of us ever voluntarily relinquish the comforts and conveniences of modern life. Government rationing is required to enable us to enjoy again the blessings of those "good old days." The product of the science laboratory has in many cases had a tremendous impact on our civilization.

It is not so long ago that about 1,800 pounds of living animal tissue was required to produce a horsepower. Now, through the work of science and engineering laboratories, we are able to produce an explosion-type engine weighing less than one pound per horsepower. The 1,800-pound source of a horsepower was of necessity a patient plodder on the face of the earth. The airplane engine takes us up into the air and makes possible the crossing of the Atlantic, even between daylight and dark.

The radio makes possible the sending of intelligence to the far corners of the earth in a small fraction of a second.

In these and other ways science has made the earth in effect so small that isolation is no longer possible, and the process has taken place so rapidly that we have as yet failed to make the necessary readjustment.

Science has been blamed by some for the misuse of its product, and you will remember that in England Dean Inge even proposed a moratorium on science. The present emergency will serve to show the danger of such procedure to any nation subscribing to it without definite and effective guarantees that all other nations would do likewise.

Furthermore, there has never been a danger to an

individual or a nation in knowing too much—the danger always comes from knowing too little.

The development of science is now proceeding rapidly, both in educational institutions and in the industrial research laboratories of the country. It is, in the past, mainly to the college laboratory that we have looked for the development of new scientific facts and principles, leaving to the industrial laboratory the practical applications of such new knowledge. More recently there has been a marked tendency for the college to become both application and patent minded, this with the entirely praiseworthy purpose of earning money to finance its research. This has seemed to me a regrettable tendency, for the reason that it unavoidably brings the element of secrecy into this portion of the work of the university and so builds up a certain barrier, partly real and partly psychological, between it and industry. To a certain extent it puts the two institutions on a competitive, rather than on a mutually complementary, basis. It is to the university that industry should look to train men for its laboratories in the fundamentals of science, and if this work is to be well done, fundamental research must be carried on by members of the teaching staff of the university, for without this the teaching will lack freshness and vigor and inspirational quality. Financial support must, of course, be provided, and should come from the public either in the form of a government subsidy or as a contribution from industry to be in turn liquidated by the public.

The fundamental experiments underlying a great industry, and often greatly affecting the daily life of a people, are always so simple in character that they, and their place of origin in the science laboratory, are soon almost forgotten.

For example, the radio in all its varied forms is based upon the theoretical work of Maxwell and the simple confirmatory laboratory experiments of Heinrich Hertz—simple experiments involving the discharge of an electric spark between two brass rods with the consequent production of a microscopic spark between the closely spaced ends of a circular metal hoop placed at a distance. These experiments showed that electrical energy could be transmitted and received across empty space. It was, of course, a far cry from these experiments, bridging a gap of only a few feet, to present-day radio. But all our multitudinous peace- and war-time applications of radio started from those simple beginnings.

In the same way consider the dependence of the automotive industry upon some substance having the properties of vulcanized rubber. The primitive wooden wheel is still used for the oxcart, and the metal-tired wooden wheel for the horse-drawn vehicle, but for present-day speeds we must have vulcanized rubber or its equivalent. This takes us back to the simple experiment of Goodyear, who completely changed the physical properties of natural rubber by adding to it a little sulfur and a little heat, thus imparting to it the wonderful mechanical properties without which so much of present-day mechanization would be impossible.

To-day we see the majority of the scientists of the world, both university and industrial alike, recruited for use in offensive and defensive warfare, and we see science playing so vital a role that it may win or lose the struggle. All the sciences are involved. Some of this work is being done in groups which were already in existence in university, industrial, commercial, government and other laboratories; while another part is being done in new groups recruited for the purpose, mainly from the staffs of our colleges.

A tremendous contribution to the war effort is being made by our colleges not only through the activity of their scientific staffs in developing important new materials and new devices but also through the use of their teaching facilities. The importance of this last can hardly be overestimated, for we must not only have the necessary new mechanisms of warfare but we must also have an adequate number of people conversant with their use and their maintenance; and the essential basic training of these people is best given in the colleges.

While the necessity for the scientific effort involved represents in magnitude the greatest tragedy which civilization has ever encountered, much of it will have lasting value, and in many important lines research is being prosecuted at a rate which would be quite out of the question in peacetime. This is especially true in the fields of physics and chemistry. Most of this work is of so confidential a nature that it can not be publicly discussed at this time.

In the x-ray field I can say that until within the last year and a half but few radiographs had ever been made using more than a couple of hundred thousand volts. As a result of the war, industry is now employing many one-million volt radiographic outfits. These are portable and mechanically and electrically flexible and permit the ready examination of steel castings and welds up to a thickness of as much as eight inches.

Furthermore, we have recently built, with the help of Dr. Donald Kerst, of the University of Illinois, an induction electron accelerator for twenty million volts, and are now building a larger one designed to operate at voltages up to a hundred million. This last machine, used as a source of x-rays, should enable us to determine what radiographic and other useful results can be accomplished by such high-voltage radiation.

This same device should also render available for physical, chemical and medical experimentation cath-

ode rays corresponding to these same enormous voltages. In the medical field these cathode rays may have a good deal of therapeutic interest in the treatment of deep-seated tumors, since they will have sufficient penetration and since, unlike x-rays and gamma rays, their effect will be a maximum near the end of their range—properties which should facilitate the destruction of a tumor without damage to the overlying tissues.

The fluoroscopic application of x-rays is also being developed rapidly for use in industry, where it makes possible the ready examination of small metal castings. Without this non-destructive method it has sometimes been necessary to expend much machine work on a casting before a fatal hidden defect was revealed. Such wastefulness of labor is now avoided by the fluoroscopic inspection.

In the medical field we have seen an x-ray development take place during this war which will have great permanent value. It consists in the photography with the camera of the fluorescent screen image and, in the case of chest examinations, it will reduce the cost of the photographic film required to about one tenth that of the usual direct method of radiography and with but little sacrifice, we are told, in diagnostic value. This will make economically possible the chest radiography of all army recruits and the frequent chest examinations which are so desirable in the case of our young people. Many other important examples will come to light after the emergency.

Science institutions bring their votaries together, and so facilitate cooperative effort. The science laboratory and the scientific society alike facilitate the helpful interchange of ideas, thus giving both pleasure and assistance. Some individuals are by preference lone workers, but fortunately for human progress the scientist is usually a gregarious animal, taking pleasure in being with his own kind, that is, with those who can understand and appreciate his work. And by such contact he gives and receives help.

The question is sometimes raised as to whether the day of the lone scientific worker is past. While the answer is *no*, it is certain that with the great increase which has taken place in recent years in the number of science laboratories and in the number of people working in them, the percentage of our scientific progress due to the lone worker has undergone a corresponding decrease.

The science institution also helps by lending dignity to the profession of the scientist, thus playing no small role in scientific progress. The degree conferred by the institution is a badge of distinction which serves as a spur both to the acquisition of the knowledge of the past and to subsequent achievement.

In closing may I express the hope that the tradition of this laboratory, so auspiciously begun, may grow in stature and in luster with the years, and that it may be a credit to the founders of this institution and to the distinguished name this institution now bears.

Sir William Osler, lifelong advocate of medical research and himself one of its finest exemplars, in 1908, stirred by the shifting of the medical center of the world from Vienna to Berlin and by his longing to see it move again, this time across the Atlantic, wrote a letter in which he fancifully but eloquently quoted these words from "Minerva Medica":

> We Gods have but one motto—those that honor us—we honor. Give me the temples, give me the priests, give me the true worship—and I will come. . . . Where the worshippers are the most devoted, not, mark you, where they are the most numerous; where the clouds of incense rise highest, there must my chief temple be, and to it from all quarters will the faithful flock.

So now, as we dedicate this new altar to science, in the name of another great exponent of medical research, may we not feel that we are adding to the fulfilment of Osler's dream of a third of a century ago? Let us hope that here Minerva may find a new and welcome shrine, where the clouds of incense will rise ever higher, fed by an ever increasing and ever more devoted band of worshipers at the altar of truth.

SMITHSONIAN ENTERPRISES

By Dr. C. G. ABBOT

SECRETARY, SMITHSONIAN INSTITUTION

In the main hall of the old brown-stone Smithsonian building are found several of the reasons why the Institution is being frequently called upon to assist the armed services. In this hall was opened, in January, 1941, an exhibit which presented all branches of Smithsonian interests in a striking way. At either end of the hall is a world map. One map displays the world-wide distribution of Smithsonian publications. The other shows that none of the seven continents nor the seven seas has failed to be the scene of many expeditions, for collecting or for basic investigations, in which the Smithsonian has worked alone or has prominently participated.

This world-wide scope of Smithsonian interests and knowledge, associated with the intimate acquaintance with the ethnology, resources, language and climatic

conditions of out-of-the-way places which many of its staff members have gained brings to the Institution a multitude of questions from the military services, now called to far-away shores.

In order to understand the favorable position of the Institution to assist in war enterprises, it is necessary to recall the unique nature of its organization. By the will of James Smithson, an Englishman who died in 1826, the Institution "for the increase and diffusion of knowledge among men" was conceived and endowed with his private fortune of $550,000. The old brown-stone building was erected from the early income of the Smithson fund. To the original endowment has been added, for general purposes, about $1,500,000 more by gifts from later donors. Besides these resources for general purposes, the Institution is the legal owner of the Freer Gallery of Art, its contents and endowment, and the National Gallery of Art and all the works of art it contains excepting loans.

The Smithsonian Institution is the ward of the National Government, ruled by a Board of Regents comprising the Vice-President of the United States, the Chief Justice, three Senators, three Representatives and six eminent private citizens selected by the Congress. The Secretary of the Board of Regents is the executive officer. Each of the five secretaries has been of international standing as a man of research and has exercised almost unlimited authority in guiding the operations of the Institution. From Smithsonian private initiative has arisen the National Museum, Zoological Park, Bureau of American Ethnology, Bureau of International Exchanges of scientific literature, Astrophysical Observatory and the three Galleries of Art, all now appropriated for annually in large measure by the Congress, but all entrusted to the administration of the private Smithsonian Institution. Several other government enterprises, including the weather service and the fisheries service, were initiated and carried on for many years by the Institution.

Thus with powerful government support, but with independent control of a small but highly useful private income, the Institution is in position to take up instantly at any time any project within the scope of its charter, "the increase and diffusion of knowledge," which lies within its available means. Also, from its cordial world-wide contacts it gives and receives cooperation from individuals and institutions far and near, unhampered by the restrictions which necessarily surround purely government operations.

Thus, when it was learned that the National Research Council, the Council of Learned Societies and the Social Science Research Council were considering jointly the possibility of setting up the Ethnogeographic Board for correlating information on the little known areas of world conflict, for the use of the armed services and other government branches, the Smithsonian Institution was able to help to start the project at once. It offered the salary of the director, an attractive office for his use, the assistance of one of its ethnologists and assured him of all the resources of knowledge stored up in the experience and learning of its staff.

Located in the great Smithsonian hall, the Ethnogeographic Board, Dr. William Duncan Strong, director, has functioned since July, 1942, and already has been called upon to the full extent of its facilities to meet the requests for special types of knowledge which come from various services of the government.

The vast collections of the National Museum and the facilities of other Smithsonian bureaus are also of great usefulness in the identification, study and provenance of strategic materials relating to national defense, such as rubber, tin, aluminum, mica, mercury, abrasives. The staffs contain experts and technicians with outstanding experience in many fields, and the laboratories and equipment are useful in building and testing instruments and furnishing special information. Some of its staff members, because of unique knowledge, have been drawn away on special missions to aid the war effort.

Among the outstanding events of recent time in the diverse fields of the Smithsonian Institution, the greatest by far is the opening and growth of the National Gallery of Art, gift of Andrew W. Mellon, and enriched not only by his own collection of famous objects of art but by the munificent gifts of Samuel H. Kress and Joseph E. Widener, and the choice loans from other art connoisseurs.

For present-day Washington, crowded with service men and workers in the executive offices, the National Gallery is a godsend. And the more so because through the generosity of Mr. Chester Dale it has been opened for months this year on Sunday evenings, with the added beauty of choice music. Thousands attend each Sunday, and the attendance grows and grows. It may not be generally realized that the National Museum and the Zoological Park each receive about 2,500,000 visitors a year, and that at present rates the National Gallery will not fall below them.

For five years the Smithsonian Institution cooperated with the United States Office of Education and the National Broadcasting Company in the weekly broadcast "The World is Yours." The programs were selected and edited by the Institution, and written, on material furnished by its experts, by a professional script writer employed by the Smithsonian. The popularity of the program remained undiminished, and twice within the past two years an official rating service placed "The World is Yours" at the top of all

non-commercial programs on all networks. Many will regret that owing to war demands the National Broadcasting Company has felt obliged to take this program off the air.

In cooperation with the National Geographic Society and with the good will of the Mexican Government, Mr. Matthew W. Stirling, chief of the Bureau of American Ethnology, has excavated sites in southern Mexico during the past three years. His work was very fruitful. Stelae carrying the earliest known dates in American archeology were found. Also a number of colossal portrait heads in stone, having most interesting negroid characteristics. At the very end of his digging in 1941, Mr. Stirling opened a cache of nearly a hundred jade objects, unprecedented in America.

Dr. F. H. H. Roberts, Jr., also of the Bureau, continued for several years the excavation of the Lindenmeier site in northern Colorado, rich in Folsom points and bones of extinct animals. He found evidences of occupation by men contemporaneous with post-glacial phenomena of perhaps 20,000 years ago. In one instance a Folsom point was found imbedded in the vertebrum of an extinct species of bison. Bones of camels and other extinct forms evidence the antiquity of these layers, some 15 feet below the present levels. The post-glacial age of the site was determined by cooperating geologists from Harvard University.

Another branch of science has received a valuable contribution from the Institution this year. Volume 6 of the Annals of the Smithsonian Astrophysical Observatory was published in April, 1942, by the generous provision of Mr. John A. Roebling, to whose support for twenty years the investigation is greatly indebted. Volume 6 contains a detailed account of the methods employed to determine the solar constant of radiation from observations in North and South America and Africa. A table of 78 quarto pages gives the daily determinations of the years 1923 to 1939, and is followed by a table of 10-day and monthly means. It is shown that the sun's output of radiation varies from day to day in close correlation with the areas of solar faculae. The rotation period of 27 days is well shown by solar variation. Fourteen long periods ranging from 8 months to 23 years are indicated. It is claimed that the weather, both from day to day and through seasons and years, is profoundly affected by these long- and short-range solar variations. As regards wave-length, it is shown that the sun's variations are slight for red and infra-red rays, and only of the order of 1 to 3 per cent. at maximum for total radiation. But the variation increases rapidly towards shorter wave-lengths, and becomes six times as great for ultraviolet rays as for total radiation.

Such are some of the recent enterprises of the Smithsonian Institution. It would be invidious to mention the outstanding services which individuals of its staff are giving to government services in this crisis, and it would unduly prolong this paper to speak of many other interesting operations of the Institution. Its usefulness is due in great measure to its unique character as a ward of government, endowed with a small but freely disposable private income, and looked upon with respect and favor, the world around, on account of its shining history of nearly a century.

OBITUARY

DAVID WILLIAM CORNELIUS

DR. D. W. CORNELIUS, head of the physics department at the University of Chattanooga until his retirement in 1941 on account of ill health, died on June 2, 1942, at Vincennes, Indiana, at the age of 57 years. For six years his health had become increasingly poor, the illness being finally diagnosed as cerebral arteriosclerosis, something for which medical science has as yet found no cure. In spite of a reduction in teaching duties in 1939, a leave of absence in 1940 and his retirement to emeritus status in 1941, Dr. Cornelius was unable to stem the development of the fatal disease. But throughout these trying times he maintained the same cheerful disposition which has endeared him to a host of acquaintances and friends.

Dr. Cornelius was born in Linton, Indiana, and was a graduate of DePauw in 1906. He did graduate work at the Universities of California and Illinois, receiving his doctorate from the latter institution in 1912. He served as assistant in physics at DePauw, Purdue and California, as professor of physics and engineering at Ottawa (Kansas), assistant professor of physics and astronomy at the University of Kansas, instructor in physics at Missouri University, and professor of physics at Alma College, until he was called to the University of Chattanooga as head of the physics department in 1920.

Dr. Cornelius is known chiefly as an inspiring teacher and for the many physicists who have received their college training under his careful guidance. His professional interests were numerous and he was a member and regular attendant of the various scientific societies in his field. He was a member of the executive council of the American Association of Physics

Teachers, president of the Tennessee Academy of Science and vice-president of Sigma Pi Sigma, physics honor society.

The board of trustees of the University of Chattanooga by resolution mentioned, among other things, his zeal in building up the physics department and his effectiveness and high standards as a teacher. The resolution refers to the fact that "He cultivated in his students the spirit and methods of original research."

Dr. Cornelius is survived by his wife, Orrelle F. Cornelius.

MARSH W. WHITE
THE PENNSYLVANIA STATE COLLEGE

SCIENTIFIC EVENTS

A BRITISH VETERINARY EDUCATIONAL TRUST

DR. W. R. WOOLDRIDGE, president of the British National Veterinary Medical Association, has announced the formation of a Veterinary Educational Trust to raise and administer funds to provide better facilities for the education of veterinary surgeons.

It is proposed to raise a minimum sum of £1,000,000 for the trust. The *Times,* London, writes editorially as follows:

On many occasions since the last war attention has been drawn in these columns to the strange anomaly that, while breeding and exporting some of the best livestock in the world, Great Britain has lagged far behind other countries in the matter of equipment for the study and teaching of veterinary science. As long ago as 1929 a departmental committee appointed by the Minister of Agriculture strongly criticized the condition of the Royal Veterinary College. In the following year Lord Harewood raised the question in the House of Lords. Eventually a royal charter was granted constituting a new governing body, and in 1937 the present buildings of the college (replacing those that had been in use since 1791) were opened by the King and Queen. All this showed distinct, though slow, progress; yet it was not enough. Another government committee, reporting in 1938, declared that "veterinary education has been starved, the veterinary schools are overcrowded, teaching staffs are inadequate . . . facilities for clinical and practical training are insufficient and the system of education and courses of study also need amendment." These were strong criticisms, which the committee supplemented with valuable suggestions. One of these suggestions was that each veterinary school should have its field station, and in some of them—the Liverpool Veterinary College, for example—this has now been achieved. Obviously, however, there can be no complacency over a state of affairs which has lately drawn from such an authority as Sir Arthur Olver the accusation that "there is no other country in which livestock has such tremendous importance or in which so little has been done for veterinary education. . . . The necessary facilities are still not available in this country for adequate practical instruction."

With these facts in mind it is possible to appreciate the full importance of the announcement made by the president of the National Veterinary Medical Association that a veterinary educational trust has been formed with the object of improving veterinary education in this country and in the hope of raising for that purpose a fund of at least a million pounds. The sum is large, but it will give the nation an idea of the importance of the issues at stake. There are in this country, as Dr. Wooldridge has reminded us, only 2,000 active veterinary surgeons to cope with a task that could well employ twice that number. Britain's inadequate educational services, moreover, have the responsibility of providing veterinary surgeons for the Colonial Empire. The war has shown up some deficiencies here, as in other places. Animal health is an essential part of the economy of husbandry. Animal diseases must mean loss and waste and may, in some forms, have their effect upon public health. The revival of British agriculture on a permanent basis will demand all the aid that science can give and, not least, all that an improved and developing system of veterinary science can contribute in the way of prevention as well as of cure. More veterinary surgeons and a better training are needed, and a million pounds is by no means too large an endowment to demand for these purposes.

THE PROFESSIONAL TRAINING OF CHEMISTS

THE sixth progress report of the committee of the American Chemical Society on the professional training of chemists, which met in April, recently appeared in *Chemical and Engineering News.*

It is reported that students who receive the bachelor's degree from institutions in the official list after fulfilling the minimum requirements adopted by the society for the professional training of chemists become eligible for full membership following graduation and two years' experience in the field of chemistry or chemical engineering or in postgraduate study. Students who graduate in chemistry or chemical engineering from other colleges will be eligible only after five years. In each institution listed, the head of the department of chemistry will be asked after each graduation period to give the committee the names of those students who have fulfilled the specified requirements and who will thus, in the minimum time, qualify professionally for full membership in the society. Students majoring in chemistry or chemical engineering and graduates without the experience requisite for full membership may join as junior members with all privileges of membership except that of holding office. They thus gain seniority in the society and are automatically transferred to full professional status on acquiring the necessary experience.

Only a small number out of several hundred institutions have yet to be given formal consideration. For several others action has been deferred, either because the committee wishes to obtain further information or because of pending changes which may alter situations within certain institutions.

It should be emphasized that the institutions on the official list will be reviewed from time to time and their fitness to retain recognition examined. Any institution for which an unfavorable action has been given may, after an interval of two years following the date of notification of such action, request a review of its situation by the committee. The committee may drop an institution from the approved list (1) if it does not graduate each year at least one student who meets the requirements for attaining membership in the society in the minimum time; (2) if changes in department's curriculum or institution's general educational policy tend to be contrary to the best interests of fundamental chemical training; (3) if the attitude and spirit of the department do not show or manifest a definite professional point of view toward student training; (4) if departmental facilities are not kept up and maintained to an adequate standard; or (5) if quality of staff is not maintained when changes occur.

The committee recognizes that one of the most important factors in assessing the quality of work in an institution is concerned with the personnel of the staff. It is felt that the staff should be adequately trained and properly qualified to teach chemistry with its latest developments. Institutions which meet merely formal requirements without at the same time having the proper personnel can scarcely be considered as doing high-quality work.

The committee realizes that many institutions have a very high type of instruction in the elementary chemistry courses but, either through lack of funds or insufficient size of staff, are unable to give the necessary advanced work of the bachelor's degree level or are unable to give it adequately for the professional training of chemists. The committee feels strongly that this type of institution serves a very useful purpose in the American scheme of education but that it would be unwise for such institutions to attempt professional training in the sense that the committee uses that phrase. Graduate schools and employers of chemists will continue to recognize that high quality men soundly trained in the elementary principles of chemistry may be obtained from these institutions, and it should be understood that no stigma is attached to their omission from the list of institutions the committee deems to be qualified to offer professional training for chemists.

AMERICAN STANDARDS FOR 1942

The American Standards Association announces the publication of its latest list of American Standards for 1942. More than 550 standards are listed, of which 71 represent new and revised standards approved since the February, 1942, issue of the list. These are marked with an asterisk. There is a separate heading for standards developed specifically for the war effort. Another section is devoted to American Safety Standards. Other standards include definitions of technical terms, specifications for metals and other materials, methods of test for the finished product, dimensions, etc. They reach into every important engineering field and serve as a basis for many municipal, state and federal regulations. This particular list will serve as a useful reference to the engineering and purchasing departments of many manufacturing firms. Every government order is based on specifications, and standards are further used in industry in simplifying the production problem, conserving materials, pegging quality to price control, in inspection and in contracting and subcontracting. A large part of the work of the association is now undertaken in connection with war and industrial work. The association is under contract with the Federal Government to carry on an increasing amount of such work.

In each case standards approved by the association represent general agreement on the part of maker, seller and user groups as to the best current industrial practice. More than 600 organizations are taking part in this work. The list will be sent free on request by the American Standards Association, 29 West 39th Street, New York, N. Y.

FELLOWSHIPS OF THE LALOR FOUNDATION

The appointments to fellowships under the sixth annual series of fellowship awards of the Lalor Foundation, which covers the academic year of 1942 to 1943, have been announced. They are:

A. Calvin Bratton, of the University of Texas, to work with Professor E. K. Marshall, of the Medical School of the Johns Hopkins University;

Edward H. Frieden, of the University of California, to work with Professor Roger J. Williams at the University of Texas;

Francis J. Reithel, of the University of Oregon, to work with Professor Edward A. Doisy at the School of Medicine of St. Louis University;

James R. Weisiger, of the Johns Hopkins University, to work with Professor A. Baird Hastings at the Harvard University Medical School.

The work of these men is in fields closely associated with problems related to the war.

Owing to war conditions, appointments to the five remaining fellowships originally scheduled for the 1942–43 series have been postponed.

Also, as announced by Dr. C. Lalor Burdick, direc-

tor of the Lalor Foundation, the present plan of the foundation is now to discontinue its regular program of fellowship awards until the demobilization of scientific personnel at the end of the war. Thus it is planned that the usual fellowship awards of the foundation will go into a reserve to form an accumulation for post-war assignment. To date fifteen such awards will be made available at that time for post-doctorate research in chemistry. The standard annual stipend of a Lalor Foundation award is $2,000.

THE AMERICAN SOCIETIES OF AGRONOMY AND SOIL SCIENCE

THE annual meeting of the American Society of Agronomy and Soil Science Society of America will be held on November 11, 12 and 13 at the Hotel Statler in Saint Louis. Particular attention will be given to the part which agronomists can take in the war effort. The general meeting will be held on Thursday morning, November 12, at which time Dr. O. S. Aamodt, of the Bureau of Plant Industry, will discuss "The Seed Situation and the War," and Dr. F. W. Parker, of the Bureau of Plant Industry, will speak on "Fertilizer in the War Program." Following these papers a round-table discussion will be held on "The American Society of Agronomy and the War." The business meeting of the society will be held after the round-table discussion.

The Crops Section will have a general program on Wednesday afternoon and sectional meetings on Wednesday morning, Thursday afternoon and Friday, both morning and afternoon. The Soil Science Society will have its general program on Thursday afternoon and sectional programs on Wednesday and Friday. The American Society of Agronomy will hold its annual banquet on Thursday, November 12, at which time Dr. Richard Bradfield, president of the society, will give the presidential address entitled "Our Job Ahead." The Soil Science Society will hold its annual banquet on Wednesday with D. Howard Doane, Doane Agricultural Service, St. Louis, as the principal speaker. His subject will be "Soil Science and its Practical Application."

On Monday and Tuesday, November 9 and 10, the Fertilizer Committee of the society will hold its annual meeting, the meeting of the Joint Committee on Fertilizer Application and an organization meeting of the National Joint Committee on Nitrogen Utilization.

EXPEDITION OF THE DEPARTMENT OF TROPICAL RESEARCH OF THE NEW YORK ZOOLOGICAL SOCIETY

THE New York Zoological Society's forty-third expedition of the Department of Tropical Research has just come to an end. Dr. William Beebe with a staff of three—Jocelyn Crane, research zoologist, George Swanson, artist, and Henry Fleming, entomologist—left New York for Venezuela on February 12 and returned on September 20, flying both ways on Pan-American planes.

Invaluable assistance and support were given by a grant from the Committee for Inter-American Artistic and Intellectual Relations; by the Standard Oil Companies of New Jersey and Venezuela, and by the following trustees of the Zoological Society: Laurance Rockefeller, Childs Frick, Herbert L. Satterlee and George C. Clark.

The field work was carried on in the jungles about Caripito, Venezuela. The objects were to conclude life history studies begun in British Guiana ten years ago; to secure a representative record of wild life in colored motion pictures; to record the reactions of animals to the very distinct dry and wet seasons; to investigate the night life of jungle organisms; and to make observations through very high power binoculars (12, 20 and 40 diameters).

In the course of the seven months, upwards of 40,000 insects were collected and 150 color plates completed, while Jocelyn Crane took 6,000 feet of color motion picture film and more than 1,000 stills, both black-and-white and colored. The great amount of observational data obtained will be evident in forthcoming technical and popular contributions. Substantial foundations were laid for a future source of supply of living, neotropical vertebrates and invertebrates for the Zoological Park. There seems to be no reason why there should not be a continuous flow of animals suitable for exhibition, when the end of the war again permits the safe passage of oil tankers.

Five lectures with motion pictures were given in Caripito and Caracas, and constant, constructive relationships initiated and maintained with Venezuelan scientists and institutions.

SCIENTIFIC NOTES AND NEWS

DR. ARTHUR B. LAMB, professor of chemistry and director of the chemical laboratory at Harvard University, has been awarded the 1943 William H. Nichols Medal of the New York Section of the American Chemical Society.

THE John Fritz Medal has been awarded to Dr. Willis Rodney Whitney, honorary vice-president of the General Electric Company. The medal is given for "notable scientific or industrial achievement, without restriction on account of nationality or sex." The

board of award consists of representatives of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

Gerard Swope, president of the General Electric Company, New York, has been selected as the sixth recipient of the Hoover Medal. The citation reads: "Gerard Swope, engineer and distinguished leader of industry, ever deeply interested in the welfare of his fellowmen, whose constructive public service in the field of social, civic and humanitarian effort has earned for him the Hoover Medal for 1942." The presentation will be made at the winter convention of the American Institute of Electrical Engineers during the week beginning on January 25. The medal is administered by the Hoover Medal Board of Award, consisting of representatives of the four principal engineering societies. It was formally instituted on April 8, 1930, during the celebration of the fiftieth anniversary of the American Society of Mechanical Engineers, "To honor engineers whose preeminent services have advanced the well-being of mankind and whose talents have been devoted to the development of a richer and more enduring civilization, the Hoover Medal is awarded in recognition and appreciation of those principles and ideals of civic obligation and of public service exemplified by the life and work of Herbert Hoover," to whom the first award was made.

Dr. Gustav Egloff, director of research of the Universal Oil Products Company, Chicago, was elected on September 4 an honorary member of the Chemical, Metallurgical and Mining Society of South Africa, Johannesburg.

A testimonial banquet in honor of Professor Vladimir Nikolaevich Ipatieff will be given on the evening of November 20 by the American Institute of Chemists to commemorate his seventy-fifth birthday, the golden jubilee of his career in chemistry and his golden-wedding anniversary. The speakers and their subjects will be Professor Frank C. Whitmore, "Ipatieff and His Influence on World Chemistry"; Professor Vladimir Nikolaevich Ipatieff, "My Twelve Years in the United States of America"; Dr. Gustav Egloff, "Ipatieff's Influence on Industry," and Professor Ward V. Evans, "Ipatieff the Scholar."

The honorary degree of doctor of science was conferred on October 23 at the Founders' Day exercises of Lafayette College on Dr. Carl C. Speidel, professor of anatomy in the University of Virginia.

At a meeting of the Virginia Chapter of the Sigma Xi on October 29, officers for 1942–43 were elected as follows: Leland B. Snoddy, *President;* Ladley Husted, *Vice-president;* Joseph K. Roberts, *Secretary;* Lawrence R. Quarles, *Treasurer.* With these officers will be F. L. Brown and Alfred Burger to constitute the executive committee for 1942–43.

At the annual general meeting of the Physical Society, London, held on October 2, the following officers were elected for the year 1942–43: *President,* Sir Charles Darwin; *New Vice-presidents,* Professor C. D. Ellis and Dr. H. T. Flint; *Honorary Treasurer,* Dr. C. C. Paterson; *Honorary Secretaries,* J. H. Awbery (papers) and Dr. W. Jevons (business); *Honorary Foreign Secretary,* Sir Owen Richardson; *Honorary Librarian,* Professor L. C. Martin; *New Members of Council,* E. R. Davies, Dr. W. B. Mann, A. J. Philpot, Professor H. C. Webster and Dr. W. D. Wright.

Museum News states that the British Museums Association, London, elected on July 9 Dr. Douglas A. Allan, director of the Liverpool Public Museums, to the presidency. He succeeds Major S. F. Markham. M. B. Hodge, of the Bankfield Museum, Halifax, was elected honorary secretary, and S. D. Cleveland, of the City Art Gallery, Manchester, was elected honorary treasurer. F. S. Wallis continues as honorary editor of *The Museum Journal.* The association has announced that, owing to the many requests from overseas for duplicate copies of the *Journal* to replace copies lost in transit through enemy action and to the frequent loss of replacements also, it has decided not to send additional copies in future but to conserve stock and make replacements at the end of the war.

Dr. Ernest R. Hilgard, professor of psychology at Stanford University, was recently appointed head of the department of psychology to succeed Dr. Lewis M. Terman, who resigned at the close of the summer quarter. Dr. Hilgard is now in Washington, D. C., conducting morale studies for the government, and expects to remain there this year. In his absence, Dr. Paul R. Farnsworth, professor of psychology, will be acting head of the department.

At the University of Michigan, Dr. R. V. Churchill, of the department of mathematics, has been promoted to a professorship, Dr. P. S. Dwyer to an associate professorship, and Dr. R. M. Thrall to an assistant professorship.

Dr. Arthur William Mickle Ellis, professor of medicine at the University of London, was appointed Regius professor of medicine at the University of Oxford on the retirement of Sir Edward Farquhar Buzzard.

It is announced in *Nature* that Sir Henry Dale, president of the Royal Society, has accepted the directorship of the Laboratories of the Royal Institution with the Fullerian professorship, in succession to the late Sir William Bragg. Sir Henry has expressed the

wish that his appointment should be limited to a period of three years, so that the managers of the Royal Institution may then be free to consider their future policy.

DR. FRANK C. WHITMORE, research professor of organic chemistry and dean of the School of Chemistry and Physics at Pennsylvania State College, an investigator for the National Defense Research Committee, is serving on the referee board of the Chemical Division of the War Production Board.

DR. ROBERT A. KEHOE, of the Kettering Laboratory of Applied Physiology of the University of Cincinnati, has been appointed a member of the Sectional Committee on Allowable Concentrations of Toxic Dusts and Gases of the American Standards Association. The scope of the committee is to determine and promulgate the allowable concentration limits of harmful gases, fumes, vapors, dusts and mists in the atmosphere of working places, from the viewpoint of occupational disease prevention.

DR. H. C. OBERHOLSER, curator of birds at the Cleveland Museum of Natural History, is on leave of absence until January 1. He has undertaken war emergency editorial work with the U. S. Fish and Wildlife Service. W. Earl Godfrey, research associate in ornithology, will serve in Dr. Oberholser's absence.

DR. EMORY W. MORRIS, of the Kellogg Foundation, has been made chairman of the recently established council on dental health of the American Dental Association.

Museum News reports that the State Legislature of Virginia has created a commission to consider the establishment of a state museum of science. Members of the commission are Henry S. Johnson, Goochland, appointed by the Speaker of the House of Delegates; Robert K. Brock, Farmville, appointed by the president of the Senate; and W. T. Sanger, Medical College of Virginia, Richmond, and George W. Jeffers, of the department of biology of the State Teachers College, Farmville, both appointed by the Governor.

THE Iowa State College has received a grant of $10,000 from the Rockefeller Foundation for the study of national farm production and food distribution policies. The study will be under the direction of the Agricultural Experiment Station. A committee, of which Dr. T. W. Schultz is chairman, will direct the work. Other members of the committee include Dr. Margaret Reid, Dr. Walter W. Wilcox and Dr. A. G. Hart, all members of the department of economics and sociology.

DR. N. P. BEKKEDAHL, of the National Bureau of Standards, has been appointed by the Brazilian Government to organize and direct a rubber laboratory.

DR. GEORGE A. SARTON, of Harvard University, delivered on October 13 the Averill Lecture at Colby College, Waterville, Maine. The lecture was entitled "The History of Science."

JAMES S. THOMPSON, executive vice-president of the McGraw-Hill Book Company, will deliver on November 19 the seventh Bowker Lecture to be held under the auspices of the New York Public Library. His subject will be the development of the publication of technical books in the United States during this century.

FACULTY members of the Massachusetts State College at Amherst now on war leave of absence and serving with the Army Sanitary Corps are Ralph L. France, research professor of bacteriology, commissioned captain on July 27, now serving at Fort Meade, Md.; Dr. Ernest M. Parrott, instructor in chemistry, commissioned first lieutenant on September 1, now serving at Camp Devens, Mass.; Dr. Arthur S. Levine, assistant professor of food technology, commissioned first lieutenant on September 2, now serving at Fort Sam Houston, San Antonio, Texas; Dr. Monroe E. Freeman, research professor of chemistry, commissioned first lieutenant on October 10, now serving at Charleston, N. C.; and Dr. Dale H. Sieling, research professor of chemistry, commissioned first lieutenant on October 17, now serving at New Orleans.

THE thirty-fifth annual meeting of the American Society of Animal Production will be held on December 1 and 2 at the Hotel Sherman in Chicago.

THE annual fall meeting of the Industrial Minerals Division of the American Institute of Mining and Metallurgical Engineering was held in Bethlehem, Pa., under the presidency of Dr. Benjamin Miller, professor of geology at Lehigh University, with an attendance of one hundred and seventy-eight.

"THE Utilization of Scientific Apparatus in the War Effort" will be the subject of a discussion to be held by the New York branch of the American Association of Scientific Workers at the Men's Faculty Club of Columbia University on November 18, at 8:15 P.M. Dr. Joseph Greenspan, chairman of the committee on the "lend-lease" of scientific apparatus, will be the main speaker and will report the results of a questionnaire on this subject sent to local laboratories and manufacturers of scientific apparatus.

THE British Institute of Physics held a discussion on the "Education and Training of Physicists" at the Royal Institution on October 12. The discussion was based on the memorandum on the subject prepared by the planning committee of the institute.

THE Association of Special Libraries and Information Bureaux has arranged a conference to be held on November 7 and 8 in the rooms of the Royal Society. The preliminary program, according to *Nature*, includes an address by Sir Richard Gregory on "International Systems and Standards," a symposium on the use of microfilm and papers on library training and on war-time books and periodicals.

DISCUSSION

RECENT EVIDENCE REGARDING THE NATURE OF VIRUSES

SINCE Stanley[1] discovered that highly purified tobacco mosaic virus may be obtained in a crystal-like state most workers have apparently believed that the particles of certain viruses are protein macromolecules that may multiply in their hosts by a process of autocatalysis. Bawden and Pirie[2] provided further evidence for this interpretation when they discovered that tomato bushy stunt virus particles composed of nucleoprotein may come together to form strikingly symmetrical bodies which certainly have the appearance of true crystals.

Although many workers have apparently accepted this interpretation, others[3, 4] have questioned it and have considered it more probable that the virus particles are organisms, each composed of numerous molecules, that multiplication occurs by growth, followed by division and that these small organisms may exhibit electrical phenomena similar to those of molecules which cause them to aggregate in an orderly arrangement to form crystal-like structures. Further evidence favoring this interpretation was provided by Kunkel,[5] who reported that he was able to culture certain filterable organisms and that these organisms produce birefringent colonies that resemble spheroid crystals.

As Lauffer[6] and Frampton[7] have indicated, one would expect that if each virus particle were a macromolecule, all the particles of a given virus should have the same size and form. The electron micrographs[8] of viruses having spheroidal particles, although not as clear as desired, have indicated a certain amount of uniformity in the size and form of the particles of a given virus. However, viruses having rod-shaped particles, although showing a marked uniformity in width, have shown great variation in length.[8, 9] Frampton[7] has reported measurements of the length of the tobacco mosaic virus particles shown in the electron micrographs of Stanley and Anderson[8] and Anderson and Stanley.[10] He implied that the lengths show sufficient regularity to indicate that the virus particles may be composed of units 37 mμ long, joined end to end. We can not agree with this interpretation of the results. It appears to us that his measurements do not show sufficient regularity to warrant this interpretation. We have accordingly also made measurements of the length of the tobacco mosaic particles in Figs. 1 and 2 of Anderson and Stanley[10] and Figs. 3, 4, 5 and 6 of Stanley and Anderson.[8]

The results were treated statistically[11] as follows: It was assumed that the virus particles have a length of K 35, where K = 1, 2, 3, 4, etc., and that the measurements would be normally distributed about these expected values with variance $\overline{\sigma}$ determined to be 8 mμ. The unit 35 mμ was chosen because it is a factor of 280 mμ, which has been reported[8] as the most common length of the tobacco mosaic particle and because it is close to the value 37 mμ suggested by Frampton as a unit. $\overline{\sigma}$ is the average of the best unbiased estimates of the σ of the measurements. Each particle was measured 3 times and only clearly defined particles were measured. Small particles resembling those of amorphous material were not measured because we could not be sure that they were virus particles.

The observed measurements were then compared with the theoretical distribution by means of a chi-square test. From this comparison it may be concluded that if the theoretical distribution is proper the chance of obtaining the observed values is less than 1 in 1,000 and that there is, therefore, no significant evidence of tobacco-mosaic virus particles being composed of visible uniform units around 35 mμ long.

A frequency curve of these length measurements is shown in Fig. 1. It is also evident from visual inspection as well as statistical treatment of the curve that there is little evidence of the larger particles being composed of shorter visible uniform units joined end to end. If the particles were composed of units 37 mμ long one would expect peaks at 111, 148, 185, 222, 259, 296, etc. Although some of the peaks occur near some of these points, this does not occur with sufficient regularity to be significant.

1 *Am. Jour. Bot.*, 24: 59, 1937.
2 *Brit. Jour. Exp. Path.*, 19: 251, 1938.
3 T. E. Rawlins and W. N. Takahashi, SCIENCE, 87: 255, 1938.
4 R. A. Gortner, SCIENCE, 87: 529, 1938.
5 SCIENCE, 91: 422, 1940.
6 *Report New Eng. Assoc. Chem. Teachers*, 4, 1941.
7 SCIENCE, 95: 232, 1942.
8 W. M. Stanley and T. F. Anderson, *Jour. Biol. Chem.*, 139: 325, 1941.
9 F. O. Holmes, *Phytopath.*, 31: 1089, 1941.
10 *Jour. Biol. Chem.*, 139: 339, 1941.
11 We greatly appreciate the advice of Mr. Mark W. Eudey, of the Statistical Laboratory, regarding the statistical work and the help of Miss Barbara M. Kennedy, who has done much of the work reported.

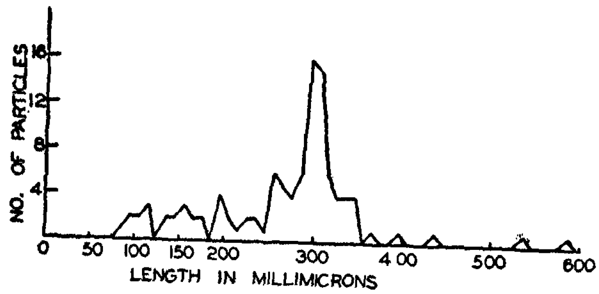

FIG. 1. Length distribution curve for tobacco mosaic virus particles.

The lengths of the particles of rib-grass strain of tobacco mosaic virus were measured on the electron micrograph shown in Fig. 2 of Holmes.[9] We have prepared a frequency curve of these lengths which is shown in Fig. 2.

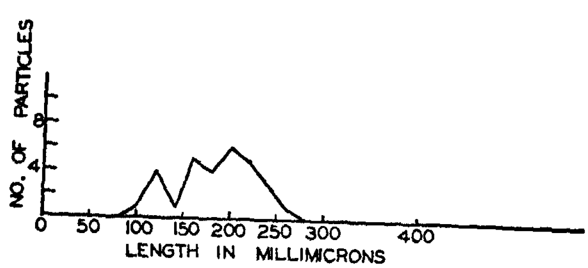

FIG. 2. Length distribution curve for particles of rib-grass strain of tobacco mosaic virus.

If one assumes that the particles of these two rod-shaped viruses are molecules and that the most common length is the most probable value for the molecular length it is evident that in each of the two rod-shaped viruses there are numerous particles too much longer and shorter than this molecular length for the difference to be due to error in measurement. It is also evident that the longer particles are not composed of 2 or more molecules of the most frequent length joined end to end.

The fact that virus particles of a given rod-shaped virus have various lengths and that the longer lengths do not appear to be multiples of the most characteristic length appears to indicate that they are not molecules.

There are several respects in which the micrographs of virus particles resemble those of bacteria. The particles of a rod-shaped virus, like many rod-shaped bacteria, are very uniform in width but vary greatly in length. The particles of a spherical virus, like most spherical bacteria, apparently have a relatively uniform diameter.

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ENZYME ACTION

THE very interesting investigation of H. C. Eyster[1] having for its purpose the explanation of the effect of narcotics on the luminous bacteria revives a problem which has been extensively discussed in the pharmacological literature. The displacement of adsorbed material from charcoal particles by narcotics was thoroughly studied by Warburg,[2] who demonstrated in several instances the adsorption of narcotics and consequent blanketing of active surfaces. Several attempts have also been made to explain the action of narcotics upon ferment action by the adsorption-theory of Traube and Warburg.[2]

The application of the results of these model-experiments on the narcosis of the living cells themselves meets, however, several difficulties. It is, for instance, demonstrated that narcotics which retard the action of the isolated diastatic ferment are markedly increasing the diastatic activity of the liver cells.[3] We doubt, therefore, whether by the experiments described by Mr. Eyster, the mechanism of the narcosis of the luminous bacteria can be satisfactorily explained.

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TRANSPARENT CALCIUM INCRUSTATION OVER ROCK PAINTINGS

ENOUGH has been written about American cave and rock shelter paintings to indicate that the different types of paintings were done throughout a long period of time, and some were made up to so late as the historic period.

In a site in Stephens County, Texas, situated ten miles northeast of Moran there is a rock shelter containing thirteen prehistoric paintings which show several unusual features. Four pictures are small, three are of problematical objects and one of a small human figure unlike the large ones. These four perhaps may have been made later than the large figures. The pictures of unusual interest are nine large red human figures. Several of these are three feet or more tall. The tallest is three feet and five inches.

Five paintings show the phallus and are of very flat-headed nude figures. Four are skirted figures with relatively more narrow heads. One of the skirted figures has the arms in position as though whirling in a dance. One of the male figures shows

1 SCIENCE, 96: 2484, 141, 1942.

2 A. G. Clark, "General Pharmacology," page 59. Berlin, 1937.

3 Lesser and Zipf, *Biochem. Zeits.*, 140, page 435, 1923; E. Geiger, Proceedings 15th International Congress of Physiology, Moscow.

two horns on his exceptionally broad flat head and one of the skirted figures has three feathers across the top of the head. All the figures are standing except one male which is lying horizontally.

Two nude figures, each one showing a large phallus, and two long slender skirted female figures were covered with a thick coating of transparent staligmitic deposit.

The four figures covered with staligmitic deposit were about the middle of the row where it seemed the mineral had flowed down across them from above. The usual thickness of the mineral deposit was about that of a table knife.

The writer has visited the spot twice and there was then no evidence of water or dampness on the wall. There is no spring flow nor seep there now. The ledge is high up near the top of a dry limestone ridge and the area above the ledge is so small that there would not be any dripping over of water except for brief periods during or immediately following rains. The carbonate of lime deposit is so thick over one of the paintings that it can not be copied, although it seems to be that of a long-skirted figure.

The various female figures are represented as in motion. One skirted figure is carrying a long-handled racquet-like object high above the head in the right hand. Another skirted figure shows the arms extended and a ball in the air beneath the left one.

All the nine large figures show an extreme flatness of the vertex, and in the males the head is exceptionally flat and broad across the top. One which shows the ears indicates very little skull above them.

When one considers the unusual artistic merit of the drawings he can not believe that this repeated depiction of exceptional vertical flatness is either accidental or coincidental. It might be a true prehistoric artist's conception of some long extinct type of Texas inhabitants whose skulls were exceptionally flat.

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SOME EARLY AMERICAN MUSEUMS

THE extremely interesting article in SCIENCE for September 18 by Dr. Simpson about the oldest natural history museum in America deserves additional comment. While the present writer accepts all Dr. Simpson's conclusions as to what may be the oldest museum now in existence on this continent, he feels constrained to point out that neither Philadelphia nor Charleston can claim the first public museum to be established in America, for that honor belongs to Matape in Sonora, where Father Eusebio Francisco Kino established a museum of natural history as early as 1681, nearly a century before the two cities mentioned by Dr. Simpson. The story has been told by Dr. Herbert E. Bolton in "Rim of Christendom."

In this connection it is appropriate to recall another early museum—that opened in 1791 by José Longinos Martínez in Mexico City. The influence of this all but forgotten pioneer has recently been recognized by the dedication of a bronze plaque to commemorate the sesquicentennial anniversary of his arrival in San Diego. Incidentally there is very little known about this early scientific explorer other than that he was an associate of Martín Sesse y Lacosta. If any of the readers of this letter should happen to have any further information about him, the writer would appreciate a communication.

Finally, although it has nothing to do with the matter under discussion, I would like to submit a comment on the censorship to which SCIENCE has been subjected. To the editorial from *The New York Times* quoted on pp. 274–5 I would like to offer an unqualified Amen. Both the pacifist and the conscientious non-pacifist can agree that whatever individual opinions they may hold toward the institution of war, the withholding of information that might lead to the alleviation of human suffering is contrary to the principles of Christian philosophy.

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SCIENTIFIC BOOKS

ELECTRICAL TERMS

American Standard Definitions of Electrical Terms. Sponsored by The American Institute of Electrical Engineers. 311 pp. New York: Published by the American Institute of Electrical Engineers.

THIS book, which carries the approval of the American Standards Association and of the Canadian Engineering Standards Association, and which is also sponsored by the American Institute of Electrical Engineers, should prove a very valuable volume to a large group of physicists and engineers. In addition to fulfilling the purpose which its title indicates, it carries in some cases in condensed form quite a little experimental material. In fact, one who is a little rusty on matters in vector analysis, potential theory, damped oscillations, etc., might reestablish much of his mental equipment by reading the first portions of the book.

If one should wish to be controversial, there are few domains providing a wider field for his acrimonious activities than one having to do with definitions. Hence there will doubtless be some differences of

opinion among physicists and engineers as to the order or importance of the definitions of some of the physical quantities, particularly those having to do with electric and magnetic fields.

Those among the purest of mathematicians who fear too much contamination with the world of matter will probably shudder at the statement on page 16 to the effect that over a given range a function of x may always be represented by a curve with the slope as its derivative. However, such matters are mentioned, not as criticisms, but to clear the conscience of the reviewer. In the same category are such statements as the definition of matter, on page 26, as a physical entity which possesses mass. Personally, this reviewer is happy with the thought, even though the entity concerned is a quantum of radiation. However, some might question the definition if they were looking for trouble. Perhaps the definition coming nearest to the realm of inviting valid criticism is that of kinetic energy, which is defined as $mv^2/2$, where m is the mass and v the velocity. Even in the domain of electrical engineering, when approaching such modern appliances as are involved in cyclotrons, etc., and even in some problems of thermionics, one has to recognize the relativistic significance of kinetic energy.

Again referring to the matter of definitions, one who read the book without already having established in his mind a consistency of order in the matter of definitions might become confused when, on page 30, he reads that "an electric current through a surface is the time rate at which positive or negative electricity passes through the surface" and finds that, up to this point, he has had no definition of a quantity of electricity in the numerical sense. However, the book is intended primarily for those who have stabilized their thoughts on these matters, and for such it is an invaluable work, both as regards its scope and presentation.

The book carries a very copious index of some fifty or more pages, which adds materially to its value. Those responsible for the preparation of this work deserve the greatest commendation and the gratitude of all students of electrical science.

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BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE, SWARTHMORE, PA.

SPECIAL ARTICLES

ANTIBACTERIAL PROPERTIES OF PROTAMINE AND HISTONE

IT is known that antibacterial compounds such as gramicidin and anionic detergents attack with almost complete selectivity only Gram-positive micro-organisms.[1, 2, 3] It has been demonstrated that the activity of these compounds is inhibited by phospholipids.[4] The possibility has been suggested that the inability of gramicidin and anionic detergents to inhibit most Gram-negative bacteria may be caused by the phospholipids of these organisms.[1, 3, 4] On this basis, it seemed possible that compounds such as protamine sulfate which are known to precipitate cephalin[5] might cause Gram-negative micro-organisms to become susceptible to these selective inhibitors. In testing this hypothesis we found that (a) certain selective inhibitors in the presence of protamine became active toward the Gram-negative organism *Escherichia coli*, and (b) the basic proteins protamine and histone themselves possess anti-bacterial properties.

Despite the extensive literature on protamines, their antibacterial properties appear to have been largely overlooked except for the isolated observation of McClean[6] that protamine inhibited the growth of *Eberthella typhosa*. This investigator also found that both protamine and histone inhibited the growth of vaccinia virus;[7] and Reiner, deBeer and Green recently showed that the respiration of *Trypanosoma equiperdum* was partially inhibited by these compounds.[8]

In our experiments, metabolic effects were measured in Warburg respirometers as previously described.[2] Each vessel contained from 5 to 15 billion organisms suspended in 3.0 ml of 0.038*M* phosphate buffer containing 0.02*M* glucose. Bactericidal power was determined by the F. D. A. phenol coefficient technique with the following modifications: (a) washed cells were employed, and were exposed to the test compounds for 5-, 15- and 45-minute periods, and (b) all tests were performed at 37° C. For the experiments with protamine several samples of salmine sulfate obtained from Dr. George A. Harrop, of E. R. Squibb and Sons, were used. The histone was prepared from fresh calf thymus by the method of Felix and Harteneck.[9]

SENSITIZATION OF GRAM-NEGATIVE MICRO-ORGANISMS

Neither Tergitol-7, a typical anionic detergent, nor

1 R. J. Dubos and R. D. Hotchkiss, *Trans. and Studies Coll. Phys. Philadelphia*, 10: 11, 1942.
2 Z. Baker, R. W. Harrison and B. F. Miller, *Jour. Exp. Med.*, 73: 249, 1941.
3 *Ibid.*, 74: 611, 1941.
4 *Ibid.*, 74: 621, 1941.
5 E. Chargaff and M. Ziff, *Jour. Biol. Chem.*, 131: 25, 1939.
6 D. McClean, *Jour. Path. and Bact.*, 34: 459, 1931.
7 *Ibid.*, 33: 1045, 1930.
8 L. Reiner, E. J. deBeer and M. Green, *Proc. Soc. Exp. Biol. and Med.*, 50: 70, 1942.
9 K. Felix and A. Harteneck, *Z. physiol. Chem.*, 157: 76, 1926.

tyrothricin[1] nor the selective antibacterial compound of Hoogerheide[10] had any effect on the respiration of *E. coli*. Protamine sulfate had an inhibitory action which could be minimized by performing the experiments at or below pH 7.0. However, when protamine was mixed with either Tergitol-7, tyrothricin or Hoogerheide's compound, the mixture inhibited respiration completely within 5 minutes. A typical experiment is shown in Fig. 1. No such potentiation of action could be demonstrated with non-selective inhibitors such as merthiolate or phenol.

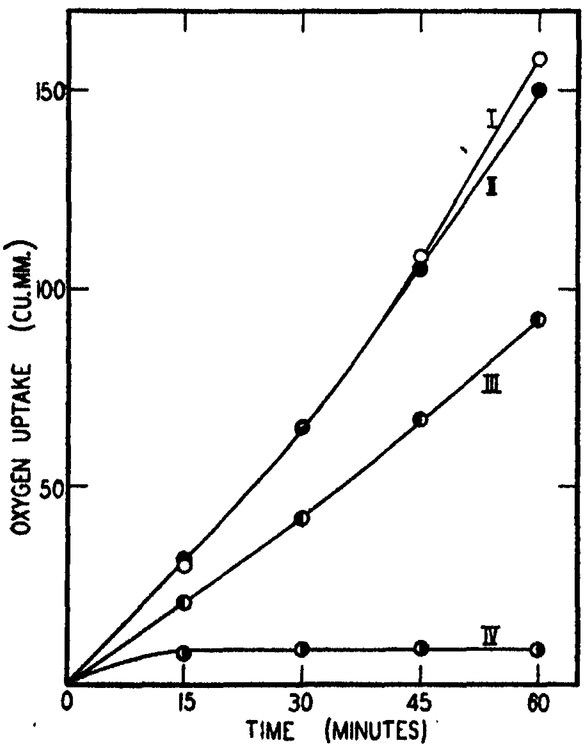

FIG. 1. Effect of Protamine and Tyrothricin on Respiration of *E. coli*. T. 38° C. Atmosphere, air. pH 5.3. 5×10^9 cells per vessel. I. Control Respiration. II. Tyrothricin (1: 15,000). III. Protamine (1: 3,000). IV. Mixture of Tyrothricin (1:15,000) and Protamine (1: 3,000).

Mixtures of protamine and tyrothricin, or protamine and Tergitol-7, were bactericidal toward *E. coli* at pH 5.3 even though considerably higher concentrations of the individual compounds were inactive.

EFFECT OF PROTAMINE OR HISTONE ALONE

Salmine sulfate exerts a powerful inhibitory action on the respiration or anaerobic metabolism of a number of species. *Gram-negative micro-organisms: E. typhosa* was completely inhibited at a 1: 38,000 dilution of the protamine, pH 8.1; and *Shigella paradysenteriae* at 1: 28,000, pH 7.0. *E. coli* was somewhat more resistant, requiring a 1: 9,000 concentration for complete inhibition at pH 8.1; *Neisseria catarrhalis* was slightly less sensitive, and *Proteus vulgaris* was completely resistant. *Anaerobic species: Clostridium perfringens* (*welchii*), *Clostridium tetani* and *Clostridium histolyticum* were extremely sensitive to protamine, *e.g.*, 1: 24,000 protamine completely inhibited anaerobic glucolysis by the Welch bacillus. *Gram-positive aerobes:* Of the members of this group tested, *Bacillus subtilis* was inhibited completely at a 1: 15,000 protamine concentration; *Staphylococcus albus*, completely at 1: 3,000; and *Staphylococcus aureus*, partially at 1: 3,000, pH 8.1.

Thymus histone also inhibited respiration of bacteria, but differed from salmine in that it had its optimum activity at an acid pH, whereas the protamine was most active at an alkaline pH, *e.g.*, 8.1. At its optimum pH, the activity of the thymus histone compared favorably with the optimal inhibitions obtained with salmine.

The bactericidal activity of protamine appears to parallel the effects on metabolism. Salmine sulfate was much more bactericidal at pH 8 to 9 than at pH 7, and was inactive at pH 5. Certain strains of *E. typhosa* were killed in 5 minutes at pH 8 by a 1: 32,000 dilution of protamine. *E. coli*, Group A streptococci and Type 1 pneumococci were also killed at relatively high dilutions of protamine, although a longer time was required. Salmine sulfate was bacteriostatic toward the Welch bacillus at a dilution of 1: 12,000, and *S. aureus* at 1: 20,000. Against *Proteus vulgaris*, the only other organism tested, protamine had neither bactericidal nor bacteriostatic power. In contrast to these results, thymus histone did not show any bactericidal or bacteriostatic activity, even at the optimum pH for its inhibition of metabolism.

It was noted that certain strains of *E. typhosa* and *E. coli* became completely resistant to the bactericidal action of the protamine.[11] None of the strains showed any variation in their resistance toward phenol.

The presence of serum, blood or broth caused a considerable reduction in the antibacterial effects of both the protamine and histone.

DISCUSSION

These results suggest certain new possibilities in the development of antibacterial compounds. (1) It is possible to "sensitize" Gram-negative micro-organisms by means of a protamine to compounds which ordinarily act only on Gram-positive species. Further

10 J. C. Hoogerheide, *Jour. Franklin Inst.*, 229: 677, 1940.

11 In the case of *E. coli* the increase in resistance to protamine seemed to be coincident with a change from smooth to rough forms. No such correlation could be made with *E. typhosa*.

extensions of this approach may be possible since our preliminary experiments with basic dyes such as methylene blue and acriflavin indicate that these dyestuffs potentiate the action of tyrothricin and the anionic detergent, Tergitol-7, in the same way as does the protamine. (2) The similarity in chemical structure of protamine, histone, tyrothricin and the germicidal protein from wheat[12] strengthens the suggestion made by Dubos and Hotchkiss[1] that certain relatively simple polypeptide configurations may serve as the basis for a large group of antibacterial compounds. Since protamines from different species of fish vary considerably in chemical composition, it should be desirable to investigate the antibacterial effects of a number of protamines. The antibacterial properties of partial hydrolysis products of the protamines and histones, as well as of similar synthetic polypeptides, merit further study.

Chemotherapeutic applications of protamine or histone are probably greatly limited by the relatively high toxicity of these compounds when administered intravenously or intraperitoneally.[8, 13] Our preliminary tests confirm the results in the literature, but indicate that these compounds have no apparent toxicity for such a tissue as the rabbit eye.

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THE EFFECT OF VITAMIN E ON THE BLOOD PLASMA LIPIDS OF THE CHICK[1]

IN a previous communication[2] Dam and Glavind have drawn attention to the fact that the two lipotropic substances, lipocaic and inositol, can to a considerable degree protect against the exudative diathesis in vitamin E deficient chicks, whereas addition of cholesterol to the vitamin E deficient diet accelerates and aggravates the symptom.

We have now made a study of the fasting level of the lipids in the blood plasma of chicks living on vitamin E deficient diets with or without the addition of lipocaic or vitamin E. This study has shown that vitamin E exerts an effect on the plasma lipids similar to that of lipocaic and that the ingestion of cholesterol acts in the opposite direction.

The observed effect of adding vitamin E or lipocaic to the vitamin E deficient diet consists in an increase of the average ratio of the phospholipids to the other lipid fractions (total lipids, cholesterol or fatty acids) of about 20 to 40 per cent., whereas addition of cholesterol to the diet lowers this ratio without increasing the absolute cholesterol content of the plasma. The values for the individual chicks within a group of 5 chicks receiving the same diet show considerable variation so that it is not possible to predict from a simple determination of the plasma lipids of one single chick whether the animal belongs to the protected group or not. This is, however, not astonishing when attention is paid to the great individual variation of the lipid values in humans which renders it impossible, for instance, to diagnose pregnancy from a plasma cholesterol determination even if there is a definite hypercholesterolemia during pregnancy.

Since any effect on the blood plasma lipids must be a consequence of changes in the metabolism of the lipids in tissue, our observations suggest that vitamin E has a lipotropic effect similar to that of lipocaic. Further investigation of this problem must determine whether direct evidence for such an effect of vitamin E on tissue lipids can be found and whether a particular fraction of the phospholipids is involved.

Whereas a sufficient dose of vitamin E gives complete protection against exudates, lipocaic does not seem to give absolute protection but merely brings down the incidence of the symptom from 80 to 100 per cent. in the group receiving the basal diet to 10 to 20 per cent. in the lipocaic group. This seems to indicate that the effect of vitamin E is of a more fundamental nature than that of lipocaic and is not confined to the lipotropic effect alone—or that lipocaic probably remedies only one of the consequences of the lack of vitamin E.

Since vitamin E and lipocaic[3] apparently can bring about the same change of the blood plasma lipids, it is likely that the vitamin E deficient chick is lacking in the active principle of lipocaic, which would mean that the formation of this substance in the body of the chick depends upon the presence of vitamin E in the diet. This question should be elucidated by further experiments.

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VITAMIN C CONTENT OF PERSIMMON LEAVES AND FRUITS

PERSIMMON leaves have been found to give excep-

[12] A. K. Balls, W. S. Hale and T. H. Harris, *Cereal Chem.*, 19: 279, 1942.

[13] W. B. Shelley, M. P. Hodgkins and M. B. Visscher, *Proc. Soc. Exp. Biol. and Med.*, 50: 300, 1942.

[1] Aided by a grant from the Josiah Macy, Jr., Foundation.

[2] H. Dam and J. Glavind, SCIENCE, 96: 235, 1942.

[3] We are indebted to Hoffman LaRoche, Inc., Nutley, New Jersey, for supply of synthetic vitamin E (Ephynal acetate) and to Dr. L. R. Dragstedt, University of Chicago, and the Lilly Research Laboratories, Indianapolis, Indiana, for lipocaic.

tionally high values in content of vitamin C when the latter was estimated by the method of Tillmans[1] and as perfected by others.[2, 3, 4, 5]

Leaves of trees found in the wild run equally high in vitamin C as those from trees of named varieties.

TABLE 1

Variety	Milligrams of Vitamin C per kilogram of leaves		Milligrams of Vitamin C per kilogram of fruit	
	Fresh green leaves	Leaves recently dried in a Bussler oven	Green fruit	Ripe fruit
Early Golden	32,500	40,700	3,000	1,050
Silkeline	20,300		3,800	950
Lucinda	22,700			
Miller	26,900	28,500	2,500	
Ruby	30,600	40,900	3,700	
Wild	32,800	38,000	2,100	
Wild	25,000	41,500	2,500	
Wild	27,100	25,500		

The fresh leaves seem to have about ten times the vitamin C concentration of the fruit. Leaves picked and held in the dried condition since October 9, 1940, still retained about one tenth of the original titratable material.

A tea made from green leaves was very acceptable, after the addition of a little sugar, as was also that made from leaves dried in a Bussler oven at 140° F. for 18 hours, with the fan on the entire time. In drying the leaves lost 58 per cent. of their weight and were quite brittle when removed from the oven.

The tea was made in the orthodox way by steeping the finely divided leaves in a cheese-cloth bag or ball for five minutes in water, after the latter had been brought to a boil. The flavor of the tea was similar to sassafras tea, and in color and general appearance it was much like a light-colored tea from tea leaves. About 60 per cent. of the titratable material in the original dried persimmon leaf was in the tea. There was about one third as much titratable material in the tea from green leaves as that from dried leaves. The titratable material in *tea* from *tea* leaves was about one per cent. of that in tea from the same weight of dried persimmon leaves.

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OKLAHOMA A. AND M. COLLEGE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SEROLOGICALLY ACTIVE POLYSACCHARIDE FROM TRICHINELLA SPIRALIS

A POLYSACCHARIDE, which gives immunologically specific reactions when tested on Trichinella-infected rabbits has been obtained in a reasonably pure chemical condition. The methods used were similar to those employed for the studies of polysaccharides from Ascaris[1] and other parasitic helminths.[2, 3]

The worms were liberated from the host tissue (hog) by peptic digestion of the infected muscle and washed with sterile saline until free of debris. The cleaned material was then rapidly frozen in a dry-ice bath and lyophiled. The dehydrated material was finely ground and suspended in 20 volumes of pH 8.0 buffer, placed in a boiling water bath and stirred vigorously with a mechanical stirrer. After 30 minutes the mixture was removed, cooled and centrifuged. The residue was washed once and the solution added to the original extract. The polysaccharide along with other soluble worm materials was then precipitated by the addition of 5 volumes of chilled 95 per cent. ethanol. In order to facilitate precipitation enough NaCl was added to give a concentration of approximately 0.5 per cent. before the addition of ethanol. After 4 hours at 4° C. a white gummy precipitate formed which was removed by centrifugation and carefully resuspended in approximately 20 volumes of pH 4.6 acetate buffer. The material which failed to redissolve was removed and discarded and the solution, which contained mostly polysaccharide, adjusted to pH 8.0 by the addition of 1.0 N sodium carbonate solution. The polysaccharide was again precipitated by the addition of sodium chloride solution and 2 volumes of 95 per cent. ethanol. Reprecipitation at pH 8.0 and redissolving at pH 4.6 was repeated until a preparation was obtained which failed to give the usual tests for protein and was completely soluble at pH 4.6 after alcohol precipitation. Five to eight treatments were required to obtain such a product. The polysaccharide was finally precipitated with ethanol and dried with several changes of absolute ethanol and ether. Approximately 0.3 gram of polysaccharide was obtained from 3.0 grams of whole worm material.

The resulting product was a fine white powder which readily dissolved in water giving an opalescent

[1] J. Tillmans and P. Hirsch, *Biochem. Zeits.*, 250: 312, 1932.
[2] O. A. Bessey and C. G. King, *Jour. Biol. Chem.*, 103: 687, 1933.
[3] H. Dick, Dissertation, Frankfurt, 1932.
[4] C. H. Knight, R. A. Dutcher and N. B. Guerrant, SCIENCE, 89: 183, 1939.
[5] N. C. Thornton, *Contrib. Boyce Thompson Inst.*, 9: 273, 1938.

[1] D. H. Campbell, *Jour. Infect. Dis.*, 59: 266, 1936.
[2] *Ibid.*, 65: 12, 1939.
[3] *Ibid.*, *Jour. Parasitol.*, 23: 348, 1937.

solution in low dilutions and failed to diffuse through Cellophane membranes. It gave a Molisch reaction in extremely high dilutions but no protein tests in relatively high concentrations. Test for nitrogen by Nessler's method on a 10 mgm sample was negative. No reducing property was observed before acid hydrolysis but rapidly appeared on treatment with 1.0 N HCl solution. Its precipitating and skin reactive properties were not affected by autoclaving for 15 minutes at 15 pounds pressure at pH 7.0.

Serological studies indicated that the polysaccharide was a good precipitating antigen. It gave typical polysaccharide plaque-like precipitates in dilutions of 1:200,000 when tested against sera from infected rabbits. Cross precipitin reactions did not occur with antisera against other roundworms such as *Ascaris suum*, *Nippostrongylus muris* or the larval tapeworm, *Cysticercus taeniaeformis*. Specificity studies with respect to the more closely allied forms such as *Trichuris* are being made at present. Although positive skin reactions were obtained in infected rabbits, the preliminary studies indicate that approximately 0.1 to 1.0 mgm of material is required to give a good reaction.

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DEPARTMENT OF BACTERIOLOGY AND PARASITOLOGY, UNIVERSITY OF CHICAGO

A SPORULATION STOCK MEDIUM FOR YEASTS AND OTHER FUNGI

MOST yeasts do not sporulate freely on the commonly used stock media such as wort-agar or grape juice agar. Carrot, beet, cucumber and potato wedges, gypsum blocks, Gorodkowa slants and other media are used to induce ascospore formation. Many yeasts sporulate on carrot wedges, but some do so only on one of the other media indicated above. During the past eight months it has been observed that agar slants made from a water extract of carrots, beets, cucumbers and potatoes will induce sporulation and at the same time serve as an excellent stock culture medium. The medium is prepared by grinding equal weights of washed, but unpeeled carrots, beets, cucumbers and potatoes and then mixing with a quantity of water equal to the total weight of the vegetables used. The mixture is autoclaved at 10 pounds pressure for 10 minutes, after which the extract is separated from the solid material by use of cheese-cloth and pressure. The pH value of the extract is approximately 5.7 and the Balling degree about 4. Two per cent. of agar is added to the extract and slants are prepared. The sterilization recommended is 15 pounds for 15 minutes.

Good sporulation has been obtained on this medium within 7 days or less with several hundred yeast cultures representing species of *Schizosaccharomyces, Endomycopsis, Saccharomyces, Zygosaccharomyces, Pichia, Zygopichia, Hansenula, Zygohansenula, Debaryomyces, Schwanniomyces, Saccharomycodes, Hanseniaspora, Nadsonia* and *Nemataspora*. By using vegetable agar Roberts[1] has been able to confirm some of the observations made by Windisch[2] concerning the sporulation of *Torulopsis pulcherrima*, the type species of a non-sporulating genus. Vegetable agar contains no added nutrients. Sufficient carbohydrates, nitrogenous substances, minerals and accessory factors are present, however, to support an excellent growth and good sporulation. When used as a stock culture medium, it offers the advantage of always having available sporulating yeasts. It is reasonable to believe that the use of vegetable agar for stock cultures should retard or eliminate the loss of sporulating ability which occurs commonly when yeasts are held in culture for long periods of time.

A limited number of trials indicate that other fungi also grow well on this medium and some show a strong tendency toward increased conidium production.

E. M. MRAK
H. J. PHAFF
H. C. DOUGLAS
UNIVERSITY OF CALIFORNIA, BERKELEY, CALIF.

1 Roberts, *Phytopath.* (Abs. in press).
2 Windisch, *Archiv. f. Mikrobiol.*, 9: 551, 1938; *ibid.*, 11: 368, 1940.

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SCIENCE NEWS

Science Service, Washington, D. C.

U. S. LEADERSHIP IN HEALTH PROTECTION

The United States is in danger of losing, if she has not already lost, her position as leader in health protection for the people of the western hemisphere, according to a report by Dr. Thomas Parran, surgeon general of the U. S. Public Health Service, at the St. Louis meeting of the American Public Health Association, who gave the result of his findings on his visits to Mexico and to the Pan-American sanitary conference in Rio de Janeiro.

When air travel between North and South America was instituted some years ago, the United States was greatly concerned over the possibility that yellow fever would be reintroduced to the country from South America. Now Brazil is rightly exercised and has made representations to our State Department because yellow fever mosquitoes and even the tse-tse fly, carrier of deadly African sleeping sickness, have been found on American airplanes entering Brazilian ports from Africa.

The Brazilian government, at a cost of $2,000,000 and with aid from the Rockefeller Foundation, which spent $200,000, has eradicated both African and American yellow fever mosquitoes from all her port cities and from eight of her states. Dr. Parran stated that only one United States port, Miami, Fla., had done anything like this.

Americans need to recognize that continental health security and solid Pan-Americanism run on a two-way track. Brazil's vast accomplishment in wiping out yellow fever danger in her cities and states does not remove the danger of yellow fever striking Brazilians or other Americans unless we and other American nations wipe out the yellow fever danger within our own boundaries.

NUTRITION IN GREAT BRITAIN

Comfort for Americans disturbed by the prospect of one cup of sugarless coffee per day, at least one meatless day per week and probable restrictions in butter and in variety of vegetables was given in a report to the association by Sir John Boyd Orr, director of Great Britain's Imperial Bureau of Nutrition.

Britain in the fourth year of war is down to something like iron rations, with all luxury foods cut out, but the diet of the people in Britain from the viewpoint of health is about as good as it was before the war. There are no signs of malnutrition, and child health is actually better than before the war. Wealthy people are eating about a third less food than before the war, while the poor are getting diets much richer in vitamins and minerals. Drastic changes in the national diet have been brought about with almost complete absence of grumbling. There is no food hoarding; it is definitely not the thing to do, according to universal public opinion.

Britain has won the war on the food front partly through lend-lease shipments of food from America, for which Sir John expressed heartfelt gratitude to the United States and Canada, and partly through greatly increased production of food and milk at home. The amount of land under the plow is now 50 per cent. greater, representing an increase of six million acres, than it was before the war, when two thirds of the food was imported. There appears to be no farm labor man-power problem in Britain. Men, women and children all work in their gardens and allotments after they have finished their day's work in factories, offices and schools.

England intends to win the peace on the food front by keeping home production up to a two thirds increase. Sir John pointed out that America must increase her food production greatly if she and the British commonwealth of nations are to avoid post-war defeat on the food front. —Jane Stafford.

TOOTH DECAY AND PLACE OF RESIDENCE

The best teeth in the nation, at least among children and men of military age, are found in Arkansas and the South and Southwest generally, was stated by Dr. Bion R. East, dentist nad public health professor of the College of Physicians and Surgeons, Columbia University.

The worst teeth are found in New England, Dr. East reported after studying draft records of the 1918 Army, the 1863–1864 Federal Army and the preliminary figures from the 1940–1942 draft. The 1918 records showed that when measured by the Army's standards, the teeth of the men of Vermont were thirty-five times poorer than those of Arkansas. Missouri rated high in excellence of its men's teeth in 1918. Study of draft rejections then showed that only three states in the nation had lower rejection rates for dental defects than did Missouri.

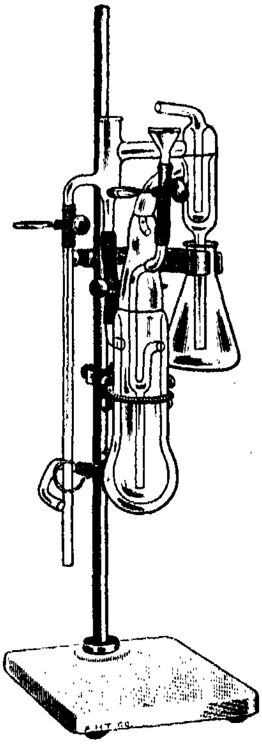
"The probability that the reported differences were not due to chance," Dr. East stated, "is strengthened by similar results obtained in a survey made of U. S. Navy recruits of 1934. In that survey the New England men, when compared with those of other sections of the country, also had the most evidence of past and present tooth decay. Arkansas, the state with the lowest rejection rate for dental defects in the draft of 1918, had the best record in this respect in the Navy's survey of 1934.

"Preliminary reports from the drafts of 1940–42 suggest that marked variations in the magnitude of the rejection rates for dental defects will again prevail among the different states. The indications are that New England will again lead the rest of the country in the percentage of men rejected for military service for poor teeth and that the men of the southern and southwestern states will again have the low rates. Similar trends in the distribution of tooth decay were found in dental surveys of children residing in different states."

Reasons for the relation between tooth decay and place of residence were not given by Dr. East, but his findings coincide with earlier findings of U. S. Public Health Service scientists on the relation of fluorine in the drinking water, mottled enamel and tooth decay. Fluorine in drinking water and the mottled enamel it causes are both prevalent in the Southwest, but the mottled enamel teeth

MICRO
KJELDAHL DISTILLING APPARATUS

Mounted with nickel-plated bronze Spring-Grip Clamps, specially designed for the convenient and safe assembly of Microchemical Apparatus, on support with Coors porcelain base and aluminum rod*



7496.

MICRO KJELDAHL DISTILLING APPARATUS, Kirk. A compact and rugged unit of Pyrex glass, for the determination of nitrogen by the usual Micro Kjeldahl methods, eliminating all rubber connections and ground joints from the distillation train. See Paul L. Kirk, "A One-Piece Glass Micro-Kjeldahl Distillation Apparatus," *Industrial and Engineering Chemistry, Anal. Ed., Vol. 8, No. 3 (May 15, 1936), p. 223.*

The distilling flask, steam generator and condensing system are made in one piece. The flask, capacity 35 ml, is provided with an outer jacket in which steam is generated. Steam reaches the solution in the distilling flask through a Y-tube with one arm sealed into the side of the flask. The stem of this tube extends close to the bottom for emptying the residue after distillation by suction created by removal of the burner from beneath the steam jacket.

The other arm of the Y-tube is sealed through the wall above the generator to the filling funnel. Above the flask is a trap and head leading directly to the small glass internal condenser which drains through a vertical delivery tube into the receiver. Water for the condenser and steam generator is introduced through the inlet above the condenser. An overflow and bypass carry the water either to the drain or to the steam generator, which is equipped with an auxiliary drain tube. Total height of the glass parts approximately 350 mm; maximum width 210 mm.

7496. Micro Kjeldahl Distilling Apparatus, Kirk, complete as shown in illustration, consisting of principal glass part, drain tube, filling funnel and receiving flask, 125 ml capacity, all excepting funnel of Pyrex glass, mounted on support with Coors porcelain base, with two nickel-plated bronze Spring-Grip Clamps, four pinch-cocks and rubber tubing connections, *but without burner* 32.52
Code Word .... *Kyrlf*

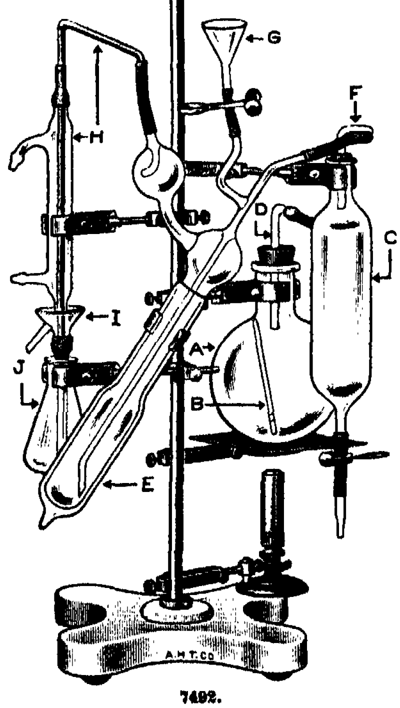
MICRO KJELDAHL DISTILLING APPARATUS, Pregl-Parnas-Wagner Improved Form. For rapid determination of nitrogen in organic substances by steam distillation of a prepared digest of ammonium sulfate and adsorption of the freed ammonia in an absorbing liquid, in accordance with methods of Pregl or similar procedures. See Pregl-Roth, "*Quantitative Organic Microanalysis,*" *3rd English edition (1937), pp. 87–90.*

Glass parts of Pyrex, with pure silver condenser tube, including an anti-bumping tube in steam generating flask and a funnel-shaped collecting tube for condensates to prevent contamination of distillate.

Consisting of steam generating flask A, 1000 ml; anti-bumping tube B; steam trap C; connecting tube D; distilling flask E; connecting tube F; filling funnel G; condenser with silver inner tube H; collecting tube I; and Erlenmeyer flask J; mounted on support with Coors porcelain base, necessary Spring-Grip Clamps, holders, ring, wire gauze, pinchcocks, burner and rubber connections.

7492. Micro Kjeldahl Distilling Apparatus, Pregl-Parnas-Wagner, Improved Form, complete as shown in illustration, with burner for use on artificial or mixed gases up to 800 B. T. U. 52.29
Code Word .... *Kyrop*

*** Our stocks of both aluminum rods and Spring-Grip Clamps are limited.**



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rarely decay. New England water supplies, so far as they have been tested, are fluorine-free.—JANE STAFFORD.

A TYPHOID FEVER VACCINE

A STEP toward development of a more powerful anti-typhoid fever vaccine has been taken in research by Dr. Jules Freund, New York City Health Department Bureau of Laboratories. Results so far of Dr. Freund's work on both typhoid and diphtheria are announced in the first annual report of the Public Health Research Institute of New York City issued by Dr. Otto A. Bessey, director of the institute.

By injecting killed tuberculosis germs and lanolin-like substances into animals, Dr. Freund has discovered, their production of typhoid fever-fighting anti-bodies is increased in response to invading typhoid germs.

"In a way, this means production of a more potent vaccine against typhoid," Dr. Thomas Rivers, director of the Hospital of the Rockefeller Institute and now Commander in the Medical Reserve Corps, U. S. Navy, as well as chairman of the institute's scientific council, explains.

"Whether this method actually gives a more potent vaccine for protection of people against typhoid fever, however, can not be stated until field experiments have been made."

Efforts to increase the potency of diphtheria toxoid by the same methods are now being made by Dr. Freund.

Nutrition studies are another project of the institute, which is said to be the only municipal organization of its kind in the world.

Nutritional assays of foods sold in New York City markets will be undertaken in order to find out whether, when the housewife buys foods for their vitamins and minerals, the foods contain the amounts of these essential diet factors she expects them to contain on the basis of food value tables. Meat, vegetables and other foods may vary widely in their vitamin and mineral content according to their region of growth because of the differences in soils in various parts of the country.

PULSATING STARS

STARS of the strange class known as RV Tauri type pulsate in fundamentals and overtones. Dr. Cecilia Payne-Gaposchkin, of the Harvard Observatory, speaking before the Association of Variable Star Observers, described her method of using organ pipes to correlate the vibrations of air columns with those of gigantic stars far off in space.

Only 29 RV Tauri-type stars are known, but there were only 13 known in 1927, so they are being found rather frequently. They are stars whose light fluctuations are extremely variable. Their light becomes very much fainter than normal at intervals, but about in the middle of these intervals, they do a less noticeable dimout. However, these "primary" and "secondary" minimums of light sometimes change places in the RV Tauri stars, and sometimes some of them seem more like Cepheids, another class of variable star which is much more abundant. Cepheid variables are pulsaters, and they undergo their alternate contractions and expansions at regular intervals—the principle of harmonic vibrations, well known to musicians, has been successfully applied to them by Dr. Martin Schwarzschild, of Columbia University Observatory.

But the RV Tauri sometimes vibrate in their fundamental tone and sometimes in the first overtone or harmonic. They may change back and forth at will, thereby producing hitherto unexplainable changes in their light fluctuations. The Cepheids resemble the heavy and low note of the long pipes; the so-called Cluster variables to the short high-pitched notes; while the RV Tauri stars were in between, giving pleasant tones of one octave separation.

All such vibrating variable stars are known to be considerably larger and brighter than our sun, which is a "dwarf" star of comparatively quiet habits—to our good fortune.

ITEMS

MOTORS and trucks now doing essential service on our highways can be operated a longer time without reconditioning by the use of expander type piston rings, P. E. Friend, of the Wilkening Manufacturing Company, told the Society of Automotive Engineers meeting in New York. Plane non-expander piston rings, Mr. Friend said, work all right so long as the cylinder is round and straight. But so soon as it is worn a little more in some spots than in others—is no longer truly circular or straight up and down—the ordinary ring fails in its function because it rides over the irregularities. The expander type, he explained, is more flexible and has inner springs which exert independent pressure against every part of the cylinder, so that the ring conforms to the variations in the contour of the cylinder wall. Consequently a worn cylinder can be used much longer, and because of the flexibility of the ring, there is less wear in the first place. At least six engine manufacturers, he said, are supplying these rings as original equipment, and many others buy them and stock them for replacement service.

THAT the cause of death in asthma and some kinds of pneumonia is a metamorphosis of the lining of the bronchial tubes which makes them bald instead of hairy was announced by Dr. A. C. Hilding, of Duluth, Minn., at the Chicago meeting of the American Academy of Ophthalmology and Otolaryngology. The fine hairs, called cilia, which are normally present in the lining of the bronchial tubes can readily and easily remove mucous secretions. But in the cases Dr. Hilding studied, the hairy lining of the tubes had changed into another kind of tissue which had no hairs. Consequently the thick mucous substance accumulated in the tubes and the patients died of asphyxiation. Aggravating the difficulty is the fact that the changed and bald cells themselves produce a secretion which they only partly extrude. This fuses with the general mass of secretion but remains anchored to the cells lining the bronchial tubes, thus aggravating the difficulty of emptying the bronchial tract. "The ciliary mechanism," Dr. Hilding reported, "is also more or less completely incapacitated in bronchopneumonia, bronchiectasis and influenzal pneumonia. Loss of function is doubtless an important factor in the progress of these diseases."

SCIENCE

VOL. 96 — FRIDAY, NOVEMBER 20, 1942 — No. 2499

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 — Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE STRUCTURE OF BIOTIN*

By Dr. VINCENT du VIGNEAUD

PROFESSOR OF BIOCHEMISTRY, CORNELL UNIVERSITY MEDICAL COLLEGE

DURING the past year my associates and I have been working on the structure of biotin and I should like to take this opportunity of presenting to you the results of this study. In 1940, our group at Cornell University Medical College, in collaboration with Dr. Paul György and Catharine S. Rose at Western Reserve, had demonstrated that biotin, the yeast-growth substance which had been isolated by Kögl, was actually identical with vitamin H.[1, 2, 3] Vitamin H was the name which had been given by György to the factor present in liver, yeast and various foods which was capable of preventing the fatal syndrome resulting from the feeding of large amounts of raw egg white, a syndrome found to occur in all species studied. We were thus able to show that biotin was involved in animal metabolism and through this work biotin became recognized as a member of the vitamin B-complex. The full role in nutrition of this newcomer to the group of vitamins is not fully understood, yet there are indications that it may be extremely important. There are now scores of laboratories working on this compound and within the next year or two much light should be thrown on the significance of this vitamin. With the demonstration of the identity of vitamin H with biotin we undertook a study of the chemical nature of this compound and have recorded from time to time some of our chemical findings. We

* A lecture delivered before the New York Section of the American Chemical Society, on October 9, 1942.

[1] P. György, D. B. Melville, D. Burk and V. du Vigneaud, SCIENCE, 91: 243, 1940.

[2] V. du Vigneaud, D. B. Melville, P. György and C. S. Rose, SCIENCE, 92: 62, 1940.

[3] P. György, C. S. Rose, K. Hofmann, D. B. Melville and V. du Vigneaud, SCIENCE, 92: 609, 1940.

have announced for example, that biotin is a cyclic urea derivative[4, 5]; that it contains sulfur in thio ether linkage[4]; that through the oxidation of the compound one can obtain adipic acid;[6] and that after the elimination of the carboxyl group of biotin, adipic acid can no longer be obtained.[7] On the basis of these facts and on consideration of the saturated character of the compound and the empirical formula, we were led to suggest that biotin was a bi-cyclic compound and that there were 5 structures capable of explaining the data up to that time; that is, last January.[8] We have now gone further with the study and have arrived at what we believe with considerable confidence to be the structure of biotin. I propose to confine my presentation to this actual chemical work, foregoing consideration of the biological aspects. I have earlier reviewed the historical side of the problem.[9]

In presenting these structural studies, I would like to pay tribute to the teamwork of the group participating in the work. I would like to acknowledge in particular the splendid contributions which Dr. Melville and Dr. Hofmann have made in this degradation work. Drs. Brown, Kilmer and Armstrong of our group have also made important contributions to the problem in connection with the synthesis of ring sulfur compounds which have helped us to understand certain aspects of biotin chemistry.[10] I wish to acknowledge the cooperation of Mr. Frohring and the Research Staff of the S.M.A. Corporation and Dr. Major and the Research Staff of the Merck Research laboratories for supplies of crystalline material. I would also like to acknowledge the collaboration in a certain phase of the work on desthiobiotin of a group from the Merck laboratories; namely, Drs. Folkers, Wolf, Keresztesy, Harris and Mozingo. I shall mention others of the group in the course of the discussion who have likewise made valuable contributions to the work. Finally I would like to acknowledge the benefit of many fruitful discussions with Professor Hans Clarke, who followed step by step the course of these studies with such great interest.

By chromatographic procedures which we have already described[11, 12] we were able to isolate biotin from liver extracts and from milk concentrates. The compound was isolated as the methyl ester, which by repeated crystallizations from a mixture of methanol and ether was obtained in long, thin, plate-like needles. The ester melted sharply on the hot-stage at 166–167°. This melting point was considerably higher than that reported by Kögl and Tönnis.[13] Subsequently Kögl has reported that his material was impure and he has now reported a melting point which is substantially in agreement with ours.[14] A chloroform solution of the ester showed an optical rotation of + 57°.

Expressed in terms of vitamin H units the various preparations of purified product that we prepared all consistently yielded, by the yeast-growth method, the high value of 27,000 ($\pm$ 10 per cent.) vitamin H units per mg. (The vitamin H unit is the amount necessary per day for 30 days to cure egg white deficiency symptoms.) Half-maximum growth of the yeast culture was obtained at a concentration as little as 1 part in 1×10^{10}, which indicates the tremendous activity of this material. Direct vitamin H assays of the crystals by Dr. György, carried out with rats by the curative method, were in agreement with this high potency. This means that approximately 0.04γ per day suffices to prevent the fatal syndrome resulting from the egg-white diet employed in the feeding of the rats, truly an amazing potency.

The analytical values we obtained from the pure crystalline compound agreed most closely with the empirical formula of $C_{11}H_{18}O_3N_2S$, which agrees with that given by Kögl. The free biotin was readily obtained by saponification of the ester with cold alkali.[15] Upon acidification of the saponification mixture with HCl, free biotin separated in long, thin needles. The analytical figures pointed to the composition $C_{10}H_{16}O_3N_2S$, which is in good agreement with the composition of the ester. An alkaline solution of the biotin showed an optical rotation of + 92°. The titration curve run by Dr. Rachele of our laboratory, who likewise carried out all the micro analyses, resembled the titration curve of a simple monocarboxylic acid. The neutral equivalent of 244 obtained from the curve agreed with that expected for a monocarboxylic acid of the empirical formula given. In the yeast-growth assay the free biotin appears to have the same potency per mole as the ester. For some micro-organisms it is necessary, however, to have biotin in the free form and not as the ester.

With the crystalline material available it was pos-

4 K. Hofmann, D. B. Melville and V. du Vigneaud, *Jour. Biol. Chem.*, 141: 207, 1941.

5 D. B. Melville, K. Hofmann and V. du Vigneaud, SCIENCE, 94: 308, 1941.

6 K. Hofmann, D. B. Melville and V. du Vigneaud, *Jour. Am. Chem. Soc.*, 63: 3237, 1941.

7 K. Hofmann, D. B. Melville and V. du Vigneaud, *Jour. Biol. Chem.*, 144: 513, 1942.

8 V. du Vigneaud, K. Hofmann and D. B. Melville, *Jour. Am. Chem. Soc.*, 64: 188, 1942.

9 V. du Vigneaud in Evans, "The Biological Action of the Vitamins," University of Chicago Press, 1942.

10 G. W. Kilmer, G. B. Brown, M. D. Armstrong and V. du Vigneaud, *Jour. Biol. Chem.*, 145: 495, 1942.

11 V. du Vigneaud, K. Hofmann and D. B. Melville, *Jour. Biol. Chem.*, 140: 643, 1941.

12 D. B. Melville, K. Hofmann, E. Hague and V. du Vigneaud, *Jour. Biol. Chem.*, 142: 615, 1942.

13 F. Kögl and B. Tönnis, *Z. Physiol. Chem.*, 242: 43, 1936.

14 F. Kögl and L. Pons, *Z. Physiol. Chem.*, 269: 61, 1941.

15 V. du Vigneaud, K. Hofmann, D. B. Melville and J. R. Rachele, *Jour. Biol. Chem.*, 140: 763, 1941.

sible to obtain preliminary information on the stability and behavior of the compound towards various reagents by inactivation and reactivation experiments using small amounts of material.[16]

In actually tackling the characterization of the functional groups by direct chemical means we first directed our attention towards the nitrogen and oxygen. Two of the three oxygen atoms, of course, had been accounted for by the carboxyl group. Possibility after possibility of how the remaining oxygen and two nitrogen atoms were arranged was eliminated. There is no point, however, in going into the many negative experiments in this direction. It became very puzzling as to what the nature of the nitrogen might be. However, the break came when a cleavage product was obtained after treatment of the biotin with strong barium hydroxide for 20 hours at 140°.[4] This brought about the formation of a new diamino acid which could be isolated in excellent yield. The analysis of the free compound led to the empirical formula $C_9H_{18}O_2N_2S$. It was clear that the split product had lost one carbon and one oxygen and taken up two hydrogens. No loss of anything else occurred. The most logical interpretation we could place on this was the cleavage of a cyclic urea derivative. The hydrolytic cleavage of biotin could therefore be expressed by the following equation.

$$C_8H_{13}S\left\{\begin{array}{l}\text{—COOH}\\ \left.\begin{array}{l}\text{—NH}\\ \text{—NH}\end{array}\right\rangle C=O\end{array}\right. \xrightarrow[140^\circ]{Ba(OH)_2} C_8H_{13}S\left\{\begin{array}{l}\text{—COOH}\\ \text{—NH}_2\\ \text{—NH}_2\end{array}\right.$$

You will note that the urea structure and the carboxyl group accounted for all the oxygen and the nitrogen, leaving the sulfur to be accounted for. Again many possibilities were eliminated and we suspected that the sulfur was present as a thio ether. A second break came when a crystalline sulfone ($C_{10}H_{16}O_5N_2S$) was obtained by the action of H_2O_2, which led to our recognition that the sulfur was present as a thio ether.[4]

It is obvious that if biotin were a urea derivative and if the barium hydroxide treatment yielded a diaminocarboxylic acid then we should be able to resynthesize biotin from the diaminocarboxylic acid by closing the ring again through urea formation. This we were able to accomplish by treatment of the diaminocarboxylic acid with phosgene[5] as shown in this equation.

$$C_8H_{13}S\left\{\begin{array}{l}\text{—COOH}\\ \text{—NH}_2\\ \text{—NH}_2\end{array}\right. \xrightarrow[NaOH]{O=C\begin{smallmatrix}Cl\\ Cl\end{smallmatrix}} C_8H_{13}S\left\{\begin{array}{l}\text{—COOH}\\ \left.\begin{array}{l}\text{—NH}\\ \text{—NH}\end{array}\right\rangle C=O\end{array}\right.$$

By this reaction biotin of the same melting point, crystalline form and optical rotation was obtained in 98 per cent. yield. A mixed melting point of the resynthesized biotin with the isolated natural biotin showed no depression. The resynthesized biotin had the same biological activity as the naturally occurring biotin. This evidence proved beyond a shadow of doubt the cyclic urea structure of biotin.

By taking into account the absence of the ethylenic linkage as well as the nature of the functional groups and the ratio of hydrogen to carbon, we were able to arrive at the conclusion that biotin must contain a bicyclic ring system. In two papers of Kögl and coworkers,[14, 17] identical conclusions were arrived at independently with regard to the nature of the functional groups. In addition they claimed to have obtained evidence that the sulfur is present in a ring. They claimed that they were able to cleave a carbon-sulfur bond and the urea ring of biotin sulfone at the same time and still found the 9 carbons and 2 nitrogens with the sulfur. As we have shown[18] this claim was based on an erroneous deduction so that the Kögl data did not afford evidence for a sulfur-containing ring. Both their evidence and ours, independently arrived at, simply showed the nature of the functional groups.

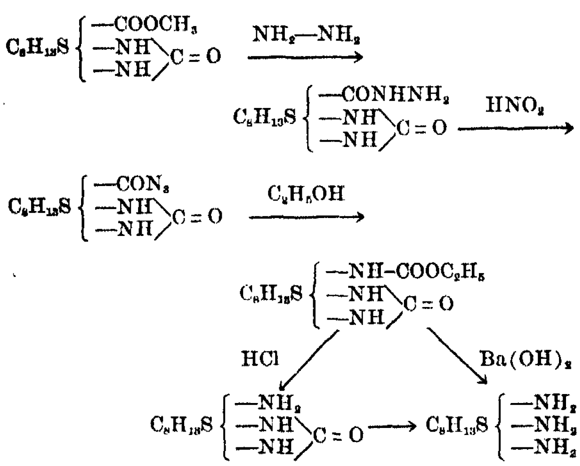
The next question, of course, was how the functional groups were arranged. As a step in this direction we subjected the diaminocarboxylic acid to oxidative degradation to see if we could pick up some characteristic split product. Fortunately we were able to obtain a split product containing 6 carbons in a chain, representing a substantial part of the 9 carbons of the diaminocarboxylic acid.[6] The oxidative degradation was first carried out with alkaline permanganate and later with nitric acid. Out of the mixture of degradation products it was possible to isolate in good yield adipic acid, the 6-carbon dicarboxylic acid. The isolation of the same compound under both these alkaline and acid oxidizing conditions minimized to a great extent the possibility of a rearrangement to an intermediate which could have yielded adipic acid. Thus the consistent formation of adipic acid as an oxidation product of biotin could be interpreted in one of two possible ways. Either biotin contains an aliphatic side chain which is capable of yielding adipic acid; or else the adipic acid has its origin in a cyclic structure which is cleaved by the oxidation. In the first case one of the carboxyl groups of the adipic acid must be the carboxyl group originally present in biotin, and it should therefore be possible, by the oxidation of a derivative of the diaminocarboxylic acid in which the carboxyl group has been eliminated, to decide between the two alternatives. After several

[16] G. B. Brown and V. du Vigneaud, *Jour. Biol. Chem.*, 141: 85, 1941.

[17] F. Kögl and T. J. de Man, *Z. Physiol. Chem.*, 269: 81, 1941.

[18] D. B. Melville, K. Hofmann and V. du Vigneaud, *Jour. Biol. Chem.*, 145: 101, 1942.

attempts by other methods the objective was achieved by a Curtius degradation.[7] In this way the carboxyl group was replaced by an amino group. Biotin methyl ester was converted to the hydrazide, from which the azide was obtained by treatment with nitrous acid. The azide was transformed into the corresponding ethyl urethane. The hydrolysis of the urethane was performed in two ways as indicated in these equations.

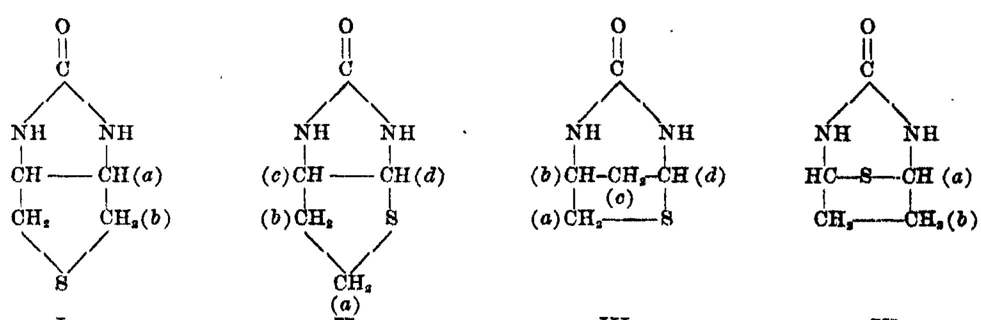


The triamine was subjected to the same oxidation procedures which we employed for the oxidation of the diaminocarboxylic acid. After preliminary experiments, 50 mg of the triamine sulfate were oxidized with potassium permanganate under the same conditions employed in the oxidation of the diaminocarboxylic acid. No trace of adipic acid could be detected in the ether-soluble oxidation products, although the amount of adipic acid which might have been formed from the relatively large amount of triamine used would have made its isolation and identification comparatively easy. The absence of adipic acid in isolable amounts among the oxidation products of the triamine therefore afforded substantial evidence that one of the carboxyl groups of the adipic acid formed by oxidation of the diaminocarboxylic acid is identical with the original carboxyl group of biotin. This means in effect that the 6-carbon, straight chain moiety giving rise to adipic acid upon oxidation is not present in biotin as a cyclic structure, but indicates the presence of an aliphatic acid side chain in biotin which is capable of yielding adipic acid on oxidation.

With all the foregoing data we were in position to list the possible structures which would fit these data. The most logical interpretation of the adipic acid data as a whole was that biotin contained a normal valeric acid side chain. The adipic acid would arise then from this side chain plus one carbon in the ring which was so linked that on oxidation it could give rise to a carboxyl group. With this deduction along with the other chemical data we had we could write, on the basis of 5 or 6 membered rings being present, only the structures indicated by formulas I, II, III and IV, with a valeric acid side chain at the positions indicated.[8]

You will note, however, that formulas II, III and IV have sulfur and nitrogen attached to the same carbon. We felt that the remarkable stability of the diaminocarboxylic acid towards strong hydrolytic agents rendered very unlikely structures where nitrogen and sulfur were attached to the same carbon. Such compounds described in the literature are unstable to strong alkali. As we stated in the preliminary note, formula I with either the side chain in position (a) or position (b) was the most likely formula for biotin.

In order to keep absolutely within the bounds of our data we had to grant another possibility although it seemed to us less likely. It was theoretically possible that the adipic acid might arise from the decarboxylation of a malonic or α-substituted β-keto acid arising during the oxidation, in which case a butyric rather than a valeric acid side chain might be present. On the basis of such a construction we could arrive at 3 additional structures, as shown in formulas V, VI and VII.



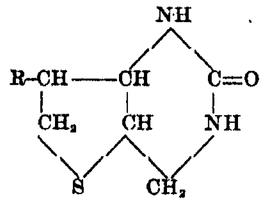
I II III IV

Side Chain = $CH_2CH_2CH_2CH_2COOH$

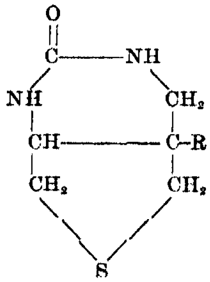
At this stage we therefore had before us 5 structures which we felt were the only ones which could possibly explain the chemical evidence which we had so far adduced. As we pointed out[8] all the formulas with the exception of formula Ia involved, in the

formation of adipic acid, the oxidative cleavage of a carbon-sulfur bond. As we stated it, formulas Ib, V, VI and VII involved the assumption that the carbon atom attached to the sulfur and proximal to the side chain would be oxidized to a carboxyl group. We pointed out that if this assumption were invalid then only structure Ia remained. We did not rule out this assumption. In other words we considered these formulas involving the splitting of the carbon-sulfur bond as entirely possible and our further work was based on the allowance of that assumption. This left us then at this stage with 5 possible structures for biotin, with preference for the fused 5-membered rings with a valeric acid side chain. We had hoped that x-ray data might aid us in ruling out some of the structures. Dr. Fankuchen was kind enough to make in pale yellow needles. The analytical values for the compound agreed somewhat more closely with the composition of the quinoxaline rather than the dihydroquinoxaline derivative. The red color which was obtainable on treatment of the condensation product with sulfuric acid was in favor of this.

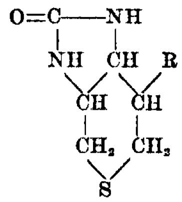
The formation of the derivative with phenanthrenequinone indicated strongly if not proved that the diaminocarboxylic acid is a 1,2 diamine and that therefore biotin possesses a 5-membered urea ring. This is in contradiction to the suggestion of Kögl and Pons[14] that biotin is a 6-membered cyclic urea derivative. The evidence on which they based this suggestion was simply the comparative stability of 5- and 6-membered cyclic urea derivatives toward hydrolysis. The demonstration that the diaminocar-



V



VI



VII

R = $CH_2CH_2CH_2COOH$

such an analysis of biotin, but felt that the x-ray data did not warrant a decision on which structure was the more likely in the presentation of his x-ray data.[19] Since our determination of the structure by chemical means he has obtained evidence in favor of it from a study of the x-ray pattern of biotin sulfone.

In the chemical attack it is obvious that an important step would be the establishment of whether the urea ring was 5- or 6-membered, or to put it another way, whether the diaminocarboxylic acid derivable from biotin was a 1,2 or 1,3 diamine. The ring closure with phosgene could not decide between these 2 possibilities and we therefore searched for a ring closure for the diaminocarboxylic acid which could decide between a 1,2 and 1,3 diamine. This was accomplished by recourse to the formation of a derivative of the diaminocarboxylic acid with phenanthrenequinone.[20] While it is well known that many 1,2 diamines will condense with phenanthrenequinone, there is no evidence that 1,3 diamines form a ring structure with this reagent. The diaminocarboxylic acid when treated with phenanthrenequinone yielded a condensation product melting at 202–204° which crystallized

boxylic acid was a 1,2 diamine and that biotin therefore contained a 5-membered urea ring eliminated two of the five structures which we have been discussing, namely, those containing the 6-membered urea ring—that is, structures V and VI. The diaminocarboxylic acid Ia, Ib or VII could form a phenanthrenequinone derivative.

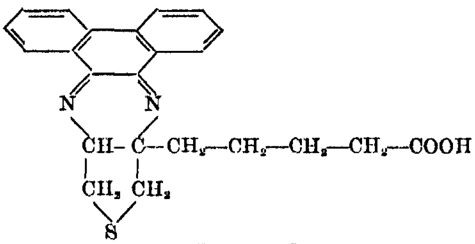
As indicated earlier, the behavior of the phenanthrenequinone derivative of the diaminocarboxylic acid aroused the suspicion that we might have obtained the quinoxaline rather than the dihydroquinoxaline derivative from the reaction of the phenanthrenequinone with the diaminocarboxylic acid, *e.g.*, structure Ia could form a dihydroquinoxaline (formula VIII) but would not be expected to yield the dehydrogenated derivative. On the other hand, the two remaining structures, Ib and VII, can give the dehydrogenated derivative since both carbon atoms bearing the amino groups carry hydrogen atoms. For example, structure Ib can yield a quinoxaline as shown in formula IX.

In order to settle definitely whether or not the derivative obtained from the diaminocarboxylic acid was the dihydroquinoxaline or the more fully aromatic quinoxaline, we asked Dr. Hugh H. Darby at the College of Physicians and Surgeons, Columbia

19 I. Fankuchen, *Jour. Am. Chem. Soc.*, 64: 1742, 1942.

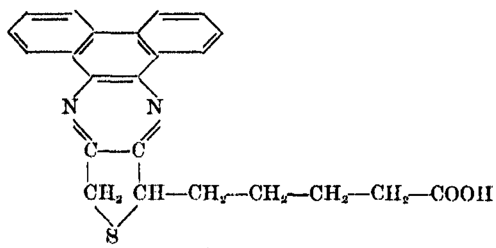
20 K. Hofmann, G. W. Kilmer, D. B. Melville, V. du Vigneaud and H. H. Darby, *Jour. Biol. Chem.*, 145: 503, 1942.

University, to examine the ultraviolet absorption spectrum of the compound and compare it with the spectra of the dihydrodibenzoquinoxaline and dibenzoquinoxaline derivatives of 3,4-diaminotetrahydrothiophene, which we had synthesized (formulas X and XI).



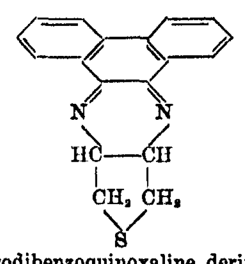
Formula VIII

One would expect a great difference in absorption spectra between these two forms, for one of them, that is the quinoxaline, is more fully aromatic. As we expected, the absorption spectra of these compounds were distinctly different. It was hoped that the absorption curve of the condensation product of the

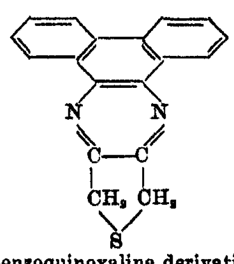


Formula IX

diaminocarboxylic acid from biotin with phenanthrenequinone would show the characteristics of one or the other of these curves. We found, in fact, that the absorption curve of the derivative from biotin was almost identical in form with that of the oxidized, or quinoxaline, derivative from the 3,4-diaminotetra-



Dihydrodibenzoquinoxaline derivative
Formula X



Dibenzoquinoxaline derivative
Formula XI

hydrothiophene, and bore little resemblance to the curve of the dihydroquinoxaline derivative. This is a very strong indication that the derivative formed from phenanthrenequinone and the diaminocarboxylic acid from biotin is a dibenzoquinoxaline, and not a dibenzodihydroquinoxaline, derivative. Thus strong evidence was afforded against structure Ia, which left structures Ib and VII still under consideration.

The evidence to decide between these has been obtained in two different ways, one by direct proof and another an indirect approach, beautifully confirming each other and pointing without equivocation to the formula Ib. One was in collaboration with the Merck group I mentioned, and the other by our own group.

The indirect proof of the sulfur ring system has resulted from a collaborative investigation with the group from the Merck Research Laboratory. Dr. Mozingo of their laboratory discovered a very ingenious reaction for removing sulfur from organic sulfides with Raney nickel, in which the sulfur was replaced with hydrogen. They found, for example, that treatment of benzoyl methionine yielded benzoylaminobutyric acid, and that the phenyl ureido derivative of methionine gave the corresponding derivative of aminobutyric acid. Still other compounds were studied and it was thought that it might be useful in removing sulfur from biotin and replacing it with hydrogen.

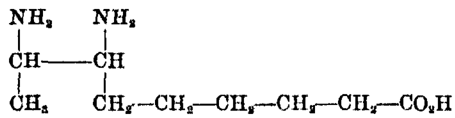
Dr. Donald Wolf applied this reaction in my laboratory to biotin methyl ester and obtained a product containing the same number of carbon atoms and two added hydrogens and no sulfur.[21] This definitely established the cyclic nature of the sulfide group. This "desthiobiotin" was hydrolyzed to a diamino acid. The desthiodiamino acid derivable from structure Ib possesses only one C-methyl group as indicated in formula XII, whereas that derivable from structure VII (formula XIII) possesses two. A Kuhn-Roth C-methyl analysis showed the presence of one. This result was in favor of structure Ib.

More positive characterization was established by oxidative cleavage. It can be seen that oxidation of the diamine should yield pimelic acid, the 7-carbon dibasic acid, if Ib were correct, but α-methyl adipic acid should be formed if VII were correct. Alkaline periodate oxidation yielded pimelic acid, which indicated that the diamino acid was the diamino pelar-

[21] V. du Vigneaud, D. B. Melville, K. Folkers, D. E. Wolf, R. Mozingo, J. C. Keresztesy and S. A. Harris, *Jour. Biol. Chem.* (in press).

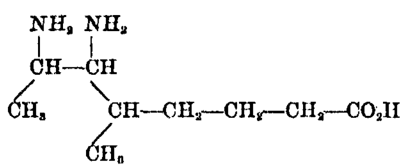
gonic acid. The pimelic acid was identified as such and as its di-p-bromphenacyl ester by comparison with authentic samples of each.

While this work was underway Dr. Folkers and Dr. Harris synthesized the diamino pelargonic acid in the Merck Laboratory. The difficulty we faced, of course, was of comparing the desthiobiotin diaminocarboxylic acid prepared from optically active biotin with the racemic synthetic compound, a difficulty increased by the fact that partial racemization had



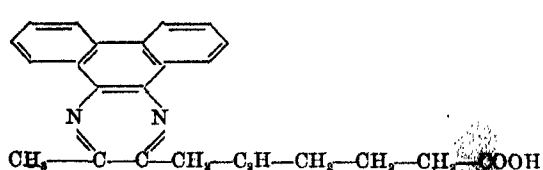
Formula XII

apparently occurred in the Mozingo reaction. It occurred to us that these difficulties could be circumvented by preparing the quinoxaline derivatives of both the compound derived from biotin and the syn-



Formula XIII

thetic product. As you can see from formula XIV the quinoxaline derivative should possess no asymmetric carbons.

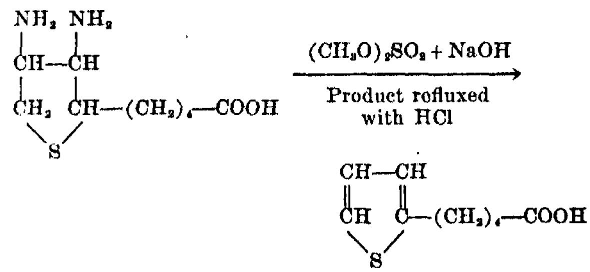


Formula XIV

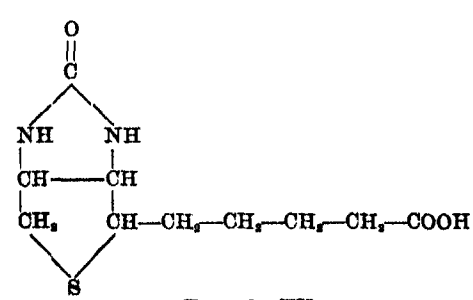
In this way a comparison could readily be made. Consequently Dr. Harris in the Merck Laboratory prepared the quinoxaline derivative of the synthetic compound. Dr. Melville prepared the quinoxaline derivative of the desthiobiotin diaminocarboxylic acid derived from biotin and found that both melted at 186–187° and also that a mixture of the two derivatives showed no depression of the melting point. Thus the desthiobiotin diaminocarboxylic acid was identified as ζ,η-diamino-pelargonic acid.

While this collaborative work was in progress we were also continuing in our laboratory another line of attack we had had underway to obtain direct evidence of the nature of the sulfur ring by keeping the sulfur intact. We felt if our formula Ib were correct we ought to be able to obtain a thiophene derivative from it by degradation, and this we could meet by synthesis. We were convinced that we should be able to obtain δ-(α-thienyl)-valeric acid from the diaminocarboxylic acid. We were so convinced that while the degradation work was progressing we synthesized the compound to have it available for comparison. Dr. Moyer of our laboratory collaborated with Dr. Melville and myself on this phase of our work.

Various attempts were made to bring about the desired decomposition. This was finally accomplished through the decomposition of the methylated diaminocarboxylic acid as shown in the following equation.[22]



The compound obtained by this degradation was compared with the sample of synthetic δ-(α-thienyl)-valeric acid. The synthetic compound was prepared by the condensation of thiophene and glutaric anhydride to give a keto acid which was reduced by a Clemmenson reduction to the thienyl valeric acid. This reaction is analogous to that used by Fieser in the synthesis of thienyl butyric acid in which succinic anhydride was condensed with thiophene. The position of the side chain in our synthetic compound was proved by oxidation of the keto acid to α-thiophenic acid. The synthetic δ-(α-thienyl)-valeric acid was found to be identical with the isolated compound, and thus by this step the five-membered sulfur ring with a valeric acid side chain attached to the carbon alpha to the sulfur was directly demonstrated. On the basis of this and the other data I have presented in this lecture we feel justified in concluding that the structure of biotin is that represented by formula Ib, as shown here in full in formula XV.



Formula XV

[22] D. B. Melville, A. W. Moyer, K. Hofmann and V. du Vigneaud, *Jour. Biol. Chem.* (in press).

THE MYCOFLORA OF BERMUDA

By Dr. FRED J. SEAVER

NEW YORK BOTANICAL GARDEN

THE Bermuda Islands, because of their nature and location, have always been of extreme interest to botanists as well as vacationists. Since the islands were built up in mid-ocean, and apparently never connected with any other existing body of land, all the land plants originally found there must have come from the outside world through natural agencies, for the islands were uninhabited up to the time of their colonization in 1609, and since many species are endemic it must be concluded that these have originated there through modification of pre-existent forms under extreme conditions of isolation.

When the writer made his first visit more than thirty years ago, in company with Dr. N. L. Britton, to study the flora of these islands, they were a "closed book" so far as our knowledge of the fungi was concerned. Up to that time few American mycologists had touched their shores, and they apparently paid little attention to the fungi so that scarcely more than a score of species were known. In fact, the islands were thought to be barren of this type of growth. However, as a result of our first two-week visit enough species were collected and identified to increase the total number to 122, which number has grown to nearly 400, exclusive of lichens, of which there are 89 species known.

The only other American mycologist who has devoted any considerable attention to the study of Bermuda fungi is Professor H. H. Whetzel, who spent a year there, 1921 to 1922, adding greatly to our knowledge of parasitic fungi, especially the rusts and smuts, and accompanied the writer on his second visit during the winter of 1926. All this work was conducted in collaboration with the local pathologists.

Two return visits were made by the writer, one during the autumn of 1938, and the other covering about the same season in 1940. While these were technically vacation visits, and of short duration, all the time was spent in the investigation of the fungi of the islands in collaboration with Mr. J. M. Waterston, then and up to the present time official plant pathologist. As a result of these two trips twenty-one new species have been described and many others added to the flora of the islands, some of which are of unusual interest from the standpoint of distribution. A few of these will be briefly discussed.

One interesting form collected on our first visit in 1912 was a little scarlet cup-fungus occurring on the dead foliage of native cedar. This was identified as *Sarcoscypha minuscula,* a species which had been described on dead foliage of cedar from Portugal just one year before we collected it in Bermuda, but nothing seems to have been known of the species in Europe outside of the original collection. While this is one of the more inconspicuous forms, it has been collected by the writer on each of his visits, as well as independently by Professor Whetzel, so that it may be said to be fairly common in those islands. So unique was the species that it was made the type of a new genus in our treatment of the cup-fungi of North America. Nothing more was heard of it until the species was reported from the Yosemite National Park, California, on incense cedar in 1941. This seemed so unusual that in our skepticism we wrote for a specimen of the California fungus. To our surprise the species was absolutely identical with that obtained in Bermuda. So, up to the present time this fungus is known from only three localities in the world: Portugal, Bermuda and the Yosemite National Park, California. It is possible that it is widely distributed and has merely escaped observation, but having been noted so many times in Bermuda by different collectors, this explanation scarcely seems plausible.

One more illustration of European species in Bermuda will be drawn from our pet group, the cup-fungi. Going back again to 1912, on that occasion another cup-fungus was collected which is larger and more conspicuous than the preceding, forming dark purple cups one half to three quarters of an inch in diameter, which by reason of their color contrast strongly with the white sandy soil on which they grow. This species, *Lamprospora Planchonis,* like the preceding, was originally described from Europe with one later collection from North Africa. It may be collected any place throughout the Bermuda Islands. Although known from Europe, and by far the commonest cup-fungus to be found in Bermuda, it has never been reported or seen from the mainland of North America, although the writer has searched for it in similar locations here. From the above it might be assumed that Bermuda had at some time had a land connection with Europe, but let us not be too hasty in our conclusions, for often strictly American species have also been found to be abundant in those islands.

Two illustrations of the latter might be cited. In 1926, in company with Professor Whetzel, an interesting fungus, *Poronia leporina,* was found on rabbit pellicles in one of the smaller islands in Hamilton Harbor. This species was originally described from material collected in Missouri in 1889, and at the time it was found in Bermuda was known from only three collections in America over a period of fifty-three

years. Yet this species was found to be abundant on one of the Bermuda Islands. Unfortunately, we have been unable to revisit this island, and at the present time it has been taken over as an American military base so that we can not check on its reoccurrence.

A second species, rare in America but abundant in Bermuda, is one described as new by the writer more than thirty years ago as *Ophionectria cylindrothecia* from a single specimen collected on cornstalks in Ohio at a much earlier but unknown date. Nothing more was seen or heard of this species until it was found among material on palm stems sent by Professor Whetzel in 1921 from Bermuda for determination. On our later visits to Bermuda it was again collected and found to be exceedingly common and abundant on the native endemic palmetto palm. This species then is known from no other place in the world except from one original collection in Ohio and abundant material obtained in Bermuda at different times and by different collectors. Just why should certain species, exceedingly rare in Europe or America, be abundant in this isolated spot? No explanation can be offered at the present time.

Of more than a score of species described as new to science from material collected on our last two visits, one only will be mentioned here, a subterranean puffball, *Scleroderma bermudensis,* described by Professor W. C. Coker, of North Carolina. Remains of this fungus were frequently noted on the sands along the shore and at first taken to be those of an earthstar. It was some time before it was discovered that it was the outer covering of a puffball which during its early stages was entirely concealed in the sand. At maturity the outer covering splits into several rays which bend outward in such a manner as to raise the spore mass as "by its bootstraps" out of the sand where the spores are easily and quickly dispersed by the wind, leaving the remains looking like pieces of dried leather. It is difficult to locate one before the outer covering begins to rupture, at which time this peculiar organism first becomes evident as a crack in the sand. This seems to be another endemic species.

All scientific exploration in these islands, which has become a naval base, has been suspended "for the duration." But there will always be a Bermuda, and it is hoped it may escape the ravages of war, and when the conflict is over it may remain the quiet, restful place so greatly beloved by such men as Woodrow Wilson, Mark Twain (Samuel Clemens) and many other outstanding Americans. At that time we hope we may resume our explorations and researches in that obscure but fascinating field, the mycoflora of Bermuda.

FRED J. SEAVER

THE NEW YORK BOTANICAL GARDEN

SCIENTIFIC EVENTS

DEATHS AND MEMORIALS

DR. CHARLES NELSON HASKINS, Chandler professor of mathematics at Dartmouth College, died on November 14 at the age of sixty-eight years.

DR. LUTHER CROUSE PETER, professor emeritus of ophthalmology of the Graduate School of Medicine of the University of Pennsylvania, died on November 12. He was seventy-three years old.

GEORGE BURR UPTON, professor of automotive engineering at Cornell University, a member of the faculty for thirty-seven years, died on October 2 at the age of sixty years.

DR. ROBERT LINTON, of Los Angeles, consulting mining and industrial engineer, died on November 12 at the age of seventy-two years.

THE New York City Board of Health on November 10 adopted a resolution in memory of the late Dr. S. S. Goldwater for "Raising to new and high levels the standards of medical care." Dr. Goldwater, who had been a commissioner of the City Board of Health, died on October 22.

THE NATIONAL REGISTRY OF RARE CHEMICALS

THE National Registry of Rare Chemicals, Armour Research Foundation, Thirty-third, Federal and Dearborn Streets, Chicago, receives requests for sources of certain chemicals at a rate of approximately two hundred and fifty per month.

Dr. Martin H. Heeren, director of the registry, sends a list of chemicals for which no source is known to the registry. If any reader has one or more in his laboratory, he is urged to communicate with the registry. Even small amounts are important, inasmuch as all requested chemicals are to be used for experimental purposes only.

1. 2,4,6,2′,4′,6′ Hexachloradiazoamino benzene
2. Quinone-bis-beta naphthylimine
3. Porphyrindien
4. 5-Amino-Nicotinic Acid
5. Diethyl Oleyl Amid Phosphate
6. Hexamethylene di iso cyanae
7. Fused Titanium rod 99 per cent. pure
8. $CaSi_2$
9. Lichenin
10. Pepsinogen
11. 1,8 Dihydroanthraquinone
12. Calcium Sulfaguayacolate
13. Ergotamine Tartrate
14. 2,3,5-triiodophenoxy acetic acid
15. 2,3,5-trichlorophenoxy acetic acid

16. 2,4-dichlorobenzoic acid
17. 2,3,5-trichlorobenzoic acid
18. 2-chloro, 3-nitro-benzoic acid
19. 2,4, diiodophenoxyacetic acid
20. 2,3, dichlorobenzoic acid

THE TRAINING OF WORKERS FOR THE WAR INDUSTRIES

OVER 1,700 war industry workers in New Haven and Fairfield Counties, Connecticut, are enrolled in the Engineering, Science and Management War Training Program for the term that began in the first week of November, according to Forrest Hughes, assistant professor of engineering drawing at Yale University, who is the representative of the university for the organization.

Under the general direction of Yale University and the U. S. Office of Education, training has already been given to 6,300 men and women since the program was begun in 1940 to overcome production bottlenecks. Nearly 3,500 in New Haven and Waterbury have been instructed by the New Haven Y. M. C. A. Junior College, while the Bridgeport Engineering Institute has trained 2,800 workers in Bridgeport and Stamford.

Six new courses are included in the 30 courses offered in New Haven, and three of the 19 courses in Bridgeport will be given for the first time this year. Instruction will be continued in Waterbury and Stamford, while a special course in production planning will be inaugurated at Greenwich and a new school unit will be organized at Meriden in the near future.

Students in these courses are industrial employees who wish to supplement their practical experience on the job with college-level theoretical training to equip themselves for more responsible positions in war industry. About 15 per cent. are women, and this proportion is increasing as more and more women are employed in production. They are found mostly in the courses dealing with inspection, drafting and supervision.

Two of the new courses in New Haven, inspection of aircraft woods and aircraft tool design, were organized at the request of two Connecticut firms manufacturing gliders. Another course, dealing with the surface treatment of metals, will bring the participants in contact with experts on lacquers and oxidizing processes. Those studying materials procurement and control will be taught the procedures and techniques of priorities. Mathematics for industrial electricians will be given as a background course, and a series of classes on the means of maintaining quality standards in mass production with "green" men will also be held. The new courses in Bridgeport will cover the subjects of fuels and their economical use, industrial electricity and fundamentals of radio (advanced).

At the request of the Government and under the auspices of the Engineering, Science and Management War Training Program, there will be given at the University of Illinois a short course which will be repeated as many times as necessary on the techniques and applications of x-ray testing methods, including radiography, microradiography and x-ray diffraction. This is given for the benefit of war industries and Government laboratories which have had to develop x-ray methods in the present emergency, in many cases with technical employees who have not had specialized training. The course as now planned will last for one week, full time. No charge will be made by the University of Illinois to those who attend, since it is being given under Government auspices. Any one who is actually engaged in x-ray testing or who is about to begin this work for any industry or laboratory is qualified and welcome. Application for admission to one of these short-course sessions should be made at once to Professor G. L. Clark, 315 Noyes Chemical Laboratory, University of Illinois, Urbana. It is hoped to organize the first courses early in December. Each session is limited to ten persons.

THE PUBLIC HEALTH RESEARCH INSTITUTE OF THE CITY OF NEW YORK

THE first anniversary of the first public health research institute of any municipality was celebrated on November 1 with the approval by Mayor La Guardia of the first annual report to the Board of Directors of the Public Health Research Institute of the City of New York, Inc., a non-profit scientific research institution. The contract, which was signed on July 1 after the Legislature had passed a bill authorizing cities to enter such agreements, provides for the payment by the city to the institute of $100,000 annually for a period of ten years, during which it will carry on fundamental research in medicine, biology, physiology, nutrition, public health and other problems of vital interest. The report covers the activities of the institute from July 1 to June 30, 1942, during which period it had carried on research for the city under a temporary contract. It was made public on November 1 by David M. Heyman, president of the board of directors, who is also president of the New York Foundation and the only lay member of the New York City Board of Health. In addition to Mr. Heyman, the board of directors of the new institute includes the Mayor, the Comptroller and the Commissioner of Health as representatives of the city; David Rockefeller as vice-president and David Morse, attorney, as secretary (both now in the Army), and Edwin F. Chinlund, president of the Postal Telegraph, Inc., as treasurer. Accompanying Mr. Heyman's report was a report by Dr. Thomas M. Rivers, director of the Rockefeller Hospital, now commander in the Medical

Reserve Corps, U. S. Navy, who is chairman of the Scientific Council of the institute.

The work of the institute will be carried out by two main divisions. Dr. O. A. Bessey, formerly of the department of pathology of the Harvard Medical School, has been appointed head of the Division of Nutrition and Physiology, and Dr. L. A. Julianelle, of the Washington University Medical School, St. Louis, has been named head of the Division of Infectious Diseases. Dr. Bessey has been appointed director of the institute to replace Dr. Ralph Muckenfuss, who has been called to take charge of the laboratories of the American Expeditionary Forces.

Members of the Scientific Council are Professor Eugene L. Opie, of Cornell University Medical College; Professor Henry C. Sherman, of Columbia University; Dr. George Baehr, of New York, now a colonel in the Army Medical Reserve Corps and chief medical officer of the Office of Civilian Defense, and Professor Michael Heidelberger, of the College of Physicians and Surgeons, Columbia University.

PSYCHOLOGY AND THE WAR

Psychology is becoming increasingly important in the furtherance of our country's war effort. Many will remember that psychology won its spurs as an applied science in the last war. To-day, psychologists are to be found not only in the military service, but in many of the government bureaus.

In the Army, psychologists are serving as classification officers, as personnel technicians and as personnel consultants. The personnel consultant, who is always a commissioned officer, is a man trained in psychology who has demonstrated that he is officer material by passing through an officers' training camp. After receiving his commission, he is eligible for an eight-weeks training course for personnel consultants conducted at the Adjutant General's School, Fort Washington, Md. The personnel officer cooperates with medical and regular officers in the disposition and placement of men. His duties include recommendations for assignment of personnel; supervision of the administration, scoring and interpretation of psychological tests; advice concerning psychological problems involving low-grade men, trouble-makers and others; aid in the selection of men for special duties. The personnel technician performs duties much like those of the personnel consultant, though perhaps not so supervisory. Both may serve as classification officers. Personnel officers are aided by enlisted men who have had some psychological training.

In the Army Air Forces at least 200 enlisted men and 50 officers have been conducting interviews, administering mental, motor and temperamental efficiency tests to aviation cadets. Much of this work is still experimental. It is under the general direction of Lieutenant-Colonel John C. Flanagan. Psychologists in the Bureau of Aeronautics are engaged in the selection of pilots, bombardiers and navigators. This work, which is carried on in cooperation with the flight surgeon, is under the direction of Lieutenant-Commander John G. Jenkins.

Government agencies such as the U. S. Office of Education, the U. S. Office of Public Health and the U. S. Employment Service all employ psychologists trained in child psychology, mental hygiene, vocational counselling and aptitude analysis. In the U. S. Civil Service, psychologists are engaged also in studies of morale, the interpretation of foreign broadcasts, the conduct of public opinion polls and other activities. Others are at work upon confidential experimental projects concerned with sensory and motor function, and various forms of behavior about which more should be known for effective utilization by the armed forces.

Because of the real need for trained psychologists, Columbia University, in its 1943 Summer Session, is planning a series of courses designed to prepare men and women with adequate undergraduate background for psychological work in the armed forces or in the government agencies. The emphasis in these courses is upon the practical and is applied with a view toward making the services of trained people immediately available.

Henry E. Garrett
Columbia University

THE YERKES LABORATORIES OF PRIMATE BIOLOGY

The name of the Yale Laboratories of Primate Biology, which up to now has been a department of the Yale School of Medicine, has been changed to the Yerkes Laboratories of Primate Biology in honor of Dr. Robert M. Yerkes, professor of psychobiology, founder and director emeritus of the laboratories.

An announcement made jointly by Yale and Harvard Universities, following a meeting of the newly formed Corporation of the Yerkes Laboratories, also states that the laboratories in Orange Park, Florida, will be conducted by Yale and Harvard Universities with the financial assistance of the Rockefeller Foundation, the Carnegie Corporation and the Samuel S. Fels Fund.

Dr. Yerkes, who continues as professor of psychobiology, has been succeeded in the directorship of the laboratories by Karl S. Lashley, research professor of neuropsychology at Harvard. Henry W. Nissen, associate professor of psychobiology at Yale, continues in the position of assistant director.

The Corporation of the Yerkes Laboratories of Pri-

mate Biology is composed of James B. Conant, president of Harvard University; William B. Claflin, Jr., treasurer of Harvard University; Henry L. Shattuck, fellow of Harvard College; Charles Seymour, president of Yale University; Thomas W. Farnam, formerly associate treasurer and comptroller, and Carl A. Lohmann, secretary, both of Yale University.

Responsibility for research and educational activities will be in the hands of Dr. Lashley and a board of scientific directors whose membership includes Dean Francis G. Blake, Yale School of Medicine; Leonard Carmichael, president of Tufts College; George W. Corner, director, department of embryology, Carnegie Institution of Washington; Derek E. Denny-Brown, professor of neurology at Harvard; Frederick L. Hisaw, professor of zoology at Harvard; William H. Taliaferro, professor of parasitology at the University of Chicago, and Professor Yerkes.

SCIENTIFIC NOTES AND NEWS

DR. CHARLES-EDWARD AMORY WINSLOW, Anna R. Lauder professor of public health at Yale University, was awarded the Sedgwick Memorial Medal in recognition of distinguished service in public health by the American Public Health Association at the seventy-first annual meeting of the association, held at St. Louis in October.

FIVE Townsend Harris Medals of the Associate Alumni of the College of the City of New York were presented at the annual dinner on November 14. Among the recipients were Dr. William J. Crozier, '12, professor of general physiology at Harvard University; Dr. Selig Hecht, '13, professor of biophysics at Columbia University; and Dr. Alvan L. Barach, '17, assistant professor of clinical medicine at the College of Physicians and Surgeons, Columbia University. The medals were awarded in recognition of "postgraduate achievement."

Chemical and Engineering News reports that E. G. Bailey, vice-president of the Babcock and Wilcox Co., New York, was presented with the first Percy Nicholls Award "for notable scientific or industrial achievement in the field of solid fuels" on September 30 at the banquet of the joint Fuels Conference of the Coal Division of the American Institute of Mechanical Engineers and Fuels Division of the American Society of Mechanical Engineers.

MEMBERS of the American Chemical Society who have been proposed by the local sections for nomination for president-elect are: Thomas A. Boyd, head of the fuel department at General Motors Research Laboratories; Carl Shipp Marvel, professor at the University of Illinois; Thomas Midgley, Jr., vice-president of the Ethyl Gasoline Corporation (now the Ethyl Corporation); Linus Carl Pauling, director of the Gates and Crellin laboratories of the California Institute of Technology; W. T. Read, dean of the School of Chemistry, Rutgers University; Ernest H. Volwiler, vice-president in charge of research and development at the Abbott Laboratories; Hobart H. Willard, professor at the University of Michigan, and Robert R. Williams, chemical director at the Bell Telephone Laboratories.

DR. MARY CAMPBELL BLISS, Margaret C. Ferguson professor of botany at Wellesley College, after serving for forty years, has retired with the title of professor emeritus.

MAJOR GENERAL ROBERT U. PATTERSON, U. S. Army, retired, formerly surgeon general, has been appointed dean of the University of Maryland School of Medicine and College of Physicians and Surgeons, and superintendent of the University Hospital in Baltimore. He succeeds Dr. Hamilton Boyd Wylie, Baltimore, who has been acting dean of the school since the retirement in 1939 of Dr. James M. H. Rowland, Baltimore.

DR. ARTHUR D. HOLMES, research chemist, director of research for the E. L. Patch Company, and Mrs. Arthur D. Holmes, formerly professor of nutrition at the University of Illinois, have been appointed to professorships on the faculty of the Massachusetts State College at Amherst.

ROBERT D. POTTER, science editor of *The American Weekly*, has become instructor in general science at New York University to aid the wartime replacement of teaching personnel now in military and naval service. Mr. Potter will continue his science writing for *The American Weekly*. Losses in the department of general science at New York University include Dr. C. C. Clark, department chairman and now First Lieutenant in the Air Corps, Lieutenant Commander Lawrence Cockaday and Lieutenant T. J. Hanwick, both stationed at Annapolis.

DR. A. C. IVY, professor of physiology at the Medical School of Northwestern University, Chicago, who is now on leave of absence from the university, has been appointed scientific director of the new Naval Medical Research Institute at Bethesda, Md., which will be concerned with the physical and mental condition of aviators, submarine crewmen and marines. The institute was placed in commission on October 27, with ceremonies at which Rear Admiral Ross T. McIntire, surgeon general of the Navy, and Rear Admiral Harold W. Smith, chief of the Division of Research, took part.

DR. WALTER H. EDDY, professor emeritus of physiological chemistry at Columbia University, has been appointed chairman of the department of nutrition and related sciences at the New York Institute of Dietetics.

DR. THURMAN B. RICE, health education consultant to the State Board of Health, Indianapolis, has been appointed acting state health commissioner. Dr. John W. Ferree, Indianapolis, has been granted leave of absence as state health commissioner to serve as lieutenant commander in the medical corps of the U. S. Navy.

Nature reports that the Lord President of the Council has appointed Sir Lawrence Bragg, Professor J. E. Lennard-Jones, Dr. A. McCance and Sir Raymond Streat to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research. Dr. G. M. B. Dobson and S. K. Thornley retired from the council on completion of their terms of office on September 30.

ANHEUSER-BUSCH, INC., has established a research unit devoted to the study of the genetics of yeast in the Henry Shaw School of Botany of Washington University, St. Louis. Dr. Carl C. Lindegren has been appointed research associate, Gertrude Lindegren, research fellow, and Grace Schaffel, research assistant.

THE Hawley Products Company, St. Charles, Ill., manufacturers of molded cellulosic and allied plastic products, has founded an industrial fellowship in Mellon Institute, Pittsburgh, for the purpose of conducting an investigational program of importance to our armed forces. Dr. J. C. Williams, an alumnus of Oberlin and of the Iowa State College, a specialist in cellulose chemistry and plastics technology, has been appointed to the incumbency of this fellowship. He will be assisted by Peter Shanta, a chemical engineer from the University of Pittsburgh.

PROFESSOR W. L. ENGELS, of the department of zoology of the University of North Carolina, has joined the Army as a private; Professor I. C. Kitchin has enlisted in the Navy as lieutenant (junior grade), and Dr. D. E. Copeland is in the Army as second lieutenant. Dr. Maurice Whittinghill, recently at Bennington College, has been added to the department as associate professor, and Dr. Claude A. Villee, Jr., of the University of California, as instructor; Dr. W. J. Bowen is continuing as assistant professor *ad interim*.

PROFESSOR ALLEN C. TESTER and Professor Joseph J. Runner, both of the department of geology of the State University of Iowa, and Dr. G. C. Knowlton, of the department of physiology, have leave of absence. Professor Tester will begin service with the rank of captain in the corps of engineers. Much of his work will be in the field of petroleum development. Professor Runner will serve in the U. S. Geological Survey as a senior geologist, devoting his time to a study of copper deposits. Active duty in the Army Air Corps with the rank of first lieutenant is the assignment of Dr. Knowlton.

Nature states that Professor A. V. Hill has heard directly from Professor J. K. Parnas, who was until 1939 professor of medical chemistry in the University of Lwów, that he had succeeded in escaping to the U.S.S.R. and is alive and well.

JOSEPH L. WEINER, deputy director of the Office of Civilian Supply of the War Production Board, will speak on December 11 at the annual meeting of the American Standards Association to be held at the Hotel Astor, New York. Mr. Weiner is also chairman of the Committee of the Government on Concentration of Production in Industry.

PROFESSOR RICHARD H. SHRYOCK, professor of American history at the University of Pennsylvania and lecturer on medical history at the School of Medicine, will deliver a lecture on "Factors Affecting Medical Research in the United States, 1800–1900" at a joint meeting of the Institute of Medicine of Chicago and the Society of Medical History of Chicago at the Palmer House on the evening of November 27.

THE Charles Sumner Bacon Lectures for 1942–1943 of the College of Medicine of the University of Illinois, Chicago, will be delivered on December 2 and 3 by Dr. Edward A. Schumann, formerly professor of obstetrics at the School of Medicine of the University of Pennsylvania.

DR. J. D. BERNAL, professor of physics at Birkbeck College, University of London, delivered at the Royal Institution the first Sir William Bragg Memorial Lecture of the Chemical Society, London, on November 19.

PROFESSOR P. A. BUXTON, director of the department of entomology of the London School of Hygiene and Tropical Medicine, gave on October 30 the first Bacot Memorial Lecture of the Lister Institute of Preventive Medicine.

THE William James lectureship at Harvard University is held this year by Dr. Edward L. Thorndike, professor emeritus of Teachers College, Columbia University. Dr. Thorndike is conducting a seminar during the first half year on "The Applications of Psychological Methods to the Social Sciences," and giving a series of lectures on "Human Nature and Human Institutions," as follows: Oct. 8, "The Original Nature of Man—The Genes of the Mind"; Oct. 15, "Modification by the Environment—Learning";

Oct. 22, "Human Relations"; Oct. 29, "The Psychology of Language"; Nov. 5, "The Psychology of Language" (continued)—"The Origin of Language"; Nov. 12, "The Psychology of Government"—"Rulers and Ruled"; Nov. 19, "The Psychology of Government" (continued)—"Laws and the Law"; Dec. 3, "The Psychology of Punishment"; Dec. 10, "The Psychology of Welfare"—"The Welfare of Individuals"; Dec. 17, "The Psychology of Welfare" (continued)—"The Welfare of Communities." The lectures are open to the public.

THE *Journal* of the American Medical Association reports that the Washington State Department of Health and the U. S. Public Health Service cooperated in the establishment of an industrial hygiene division on October 1. The new division will be housed in the same office building as the State Department of Health.

The Harvard Alumni Bulletin states that the latest reports show that four hundred members of the faculty of Harvard University have either left or are on full- or part-time leave for war service. They represent twenty per cent. of the teaching staff. At the Harvard Medical School alone, 180 faculty members have left, many of them to serve in base hospitals overseas from Northern Ireland to the central Army hospital in Australia. Faculty members in many other departments have been granted leaves of absence either to serve with the armed forces or to engage as civilians in special war work in Washington. Others have been permitted to give full time to research projects financed by the Federal Government and carried on in laboratories at Harvard and elsewhere.

THE *Journal* of the American Medical Association reports that the U. S. Army headquarters for the European theater of operations has announced that the American Red Cross-Harvard University Hospital in southern England has been taken over by the Army and will be the central laboratory for U. S. armed forces in Britain. This hospital was established in 1940 and operated jointly by the American Red Cross, Harvard University and the British Ministry of Health for the study of wartime epidemics. Its twenty-two buildings were all fabricated in the United States, from which the sixty-six thousand pieces of fabricated building material were shipped to England to be erected by British workmen. The director of the hospital was Dr. John E. Gordon, professor of preventive medicine and epidemiology at Harvard University Medical School. The staff comprised ten doctors, sixty-two nurses, six technicians and eight administrative members. The hospital will be turned over to the British Ministry of Health at the end of the war.

DISCUSSION

THE PROBABILITY OF OBTAINING POTENTIALLY DANGEROUS POOLS OF HUMAN SERUM OR PLASMA

THE mixture of plasmas or serums containing antagonistic isoagglutinins results in their inactivation.[1,2,3] The reaction takes place in a quantitative manner.[3] For this reason the practice of pooling serums or plasmas of unknown isoagglutinin content has gained wide popularity. Such pools usually consist of eight to sixteen individual serums or plasmas. Since the groups of the individual components of the pools are not customarily determined, it would seem possible that pools containing disproportionate numbers of serums or plasmas of one type might occur, so that the phenomenon of inactivation might not take place. Such a possibility possesses more than a theoretical danger, since Polayes and Squillace[4] have reported a near-fatal reaction following the transfusion of pooled plasma. The pooled plasma was later found to be capable of agglutinating the red blood cells of the recipient. In this paper we shall attempt to demonstrate the mathematical probability of obtaining potentially dangerous pools of human serum or plasma.

In order to simplify the calculation, three assumptions were made: (1) each donor contributes equally to the pool; (2) each sample has the same titer of isoagglutinins; (3) the presence of an excessive preponderance of one group in a pool renders such a pool potentially dangerous for transfusion, *e.g.*, 12 or more samples of Group A or O in a pool of 16; 6 or more samples of Group A or O in a pool of 8; 3 or more samples of Group A or O in a pool of 4.

In this investigation we have used Snyder's[5] data (based upon 20,000 random samples from the U. S. population) regarding the relative incidence of the four main blood groups: Group O, 45 per cent.; Group A, 41 per cent.; Group B, 10 per cent., and Group AB, 4 per cent.

In order to determine the probability that a certain number of any particular group (O, A, B or AB) of serum or plasma would occur by random sampling of the U. S. population in pools of sixteen, eight and

[1] S. O. Levinson and A. Cronheim, *Jour. Am. Med. Asn.*, 114: 2097, 1940.

[2] R. Jakobowicz and L. M. Bryce, *Med. Jour. Australia*, 1: 318, 1941.

[3] H. A. Davis, *Surgery*, 10: 592, 1941.

[4] S. H. Polayes and J. A. Squillace, *Jour. Am. Med. Asn.*, 118: 1050, 1942.

[5] L. H. Snyder, "Blood Grouping in Relation to Clinical and Legal Medicine," Williams and Wilkins Company, Baltimore, 1929.

four sample pools, the binomial expansion was used. Thus the expression $(P_1 + P_2)^n$ may be expanded into the general term:

$$\frac{n!}{a_1! \times a_2!} \times P_1{}^{a_1} \times P_2{}^{a_2} = P$$

Where:

P is the probability of obtaining a pool of a_1 samples of one blood group and a_2 samples of any of the other groups when n samples are taken to make the pool and P_1 is the probability of obtaining that group and P_2 is the probability of obtaining any other groups. In the calculations reported here, P_1 took values of 0.45 for group O; 0.41 for group A; 0.10 for group B; and 0.04 for group AB. Corresponding values for P_2 were taken as 0.55 for A, B, AB; 0.59 for O, B, AB; 0.90 for O, A, AB; and 0.96 for A, B, O.

In Table 1 is illustrated the probability of obtaining an excess of any group in pools of 16, 8 or 4 serums or plasmas by random sampling of the U. S. population. As might be expected, the smaller the pool, the greater is the probability of obtaining a preponderant number of serums or plasmas of one group. Moreover, Groups O and A tend to be present with greater frequency in such pools. Defining "potentially dangerous" pools as those containing more than 12 samples of O, A or B bloods in 16, more than six in pools of eight, and more than three in pools of four, then the probability of obtaining potentially

TABLE 1

PROBABILITY (AND APPROXIMATE ODDS) OF OBTAINMENT
IN POOLS OF SIXTEEN SERUMS OR PLASMAS
SAMPLES OF

Group	16 times	15 times or more	14 times or more	13 times or more	12 times or more
O	0.000003 (1:330,000)	0.000058 (1:20,000)	0.00048 (1:2,000)	0.00328 (1:300)	0.0143 (1:70)
A	0.0000006 (1:1,700,000)	0.000015 (1:66,000)	0.000173 (1:5,800)	0.00123 (1:800)	0.0062 (1:160)
B	1×10^{-16}	1×10^{-14}	8×10^{-12}	4×10^{-11}	1×10^{-9}
AB	4×10^{-23}	2×10^{-20}	3×10^{-18}	3×10^{-16}	3×10^{-14}

IN POOLS OF FOUR SERUMS OR PLASMAS
SAMPLES OF

Group	8 times	7 times or more	6 times or more
O	0.0017 (1:600)	0.0181 (1:55)	0.0884 (1:12)
A	0.008 (1:1250)	0.01 (1:100)	0.0563 (1:18)
B	1×10^{-8}	7×10^{-7}	2×10^{-5}
AB	6×10^{-12}	1×10^{-9}	1×10^{-7}

IN POOLS OF FOUR SERUMS OR PLASMAS
SAMPLES OF

Group	4 times or more	3 times or more
O	0.04 (1:25)	0.25 (1:4)
A	0.03 (1:33)	0.19 (1:5)
B	0.0001 (1:10,000)	0.0037 (1:270)
AB	0.000002 (1:500,000)	0.0002 (1:5,000)

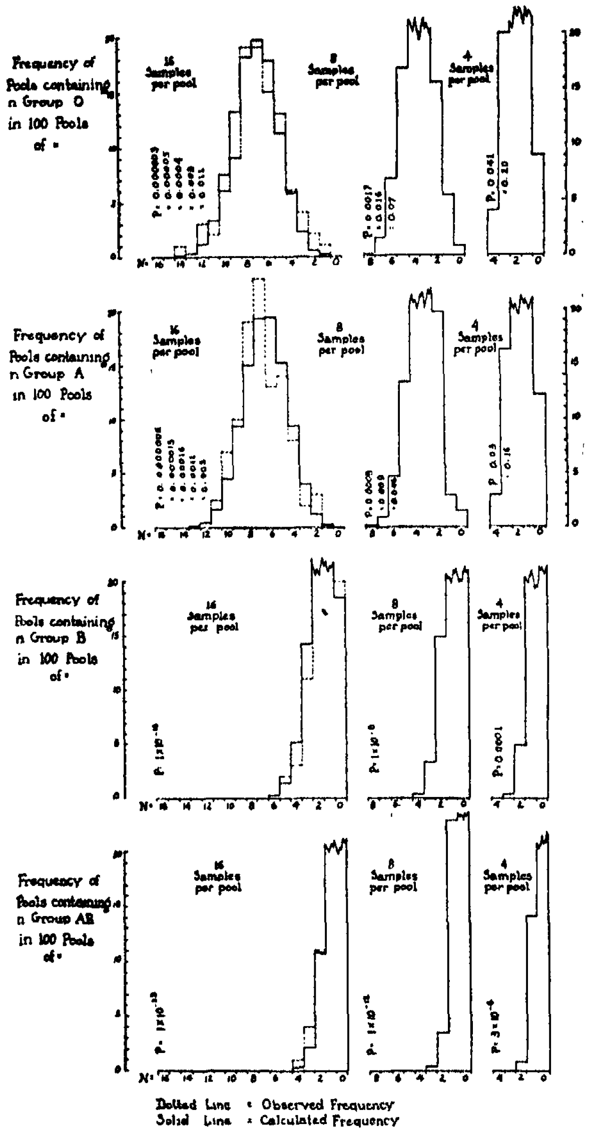


FIG. 1. Frequency distribution of 100 pools of human serum or plasma of 16, 8 and 4 components.

dangerous pools is the sum of the probabilities of obtaining predominantly O, A or B pools. For pools of sixteen, the probability is 0.02 (*i.e.*, odds of 1:50); for pools of eight, 0.14 (odds of 1:7); and for pools of four, 0.44 (odds of 1:2.3). The frequency distribution of groups in 100 pools of 16, 8 and 4 components is shown in Fig. 1. Also shown are the results obtained by actual sampling of marked balls made up to represent the blood group population. It will be noted that the observed frequency follows closely the calculated frequency in the 100 pools containing 16 components.

Certain tentative conclusions may be drawn from these results. The wide-spread practice of pooling serum or plasma without knowledge of the groups

present may lead to the production of potentially dangerous pools. This is more likely to occur when the number of components of the pool is small (such as 4) and less likely to occur when the number of components is large (such as 16). It is suggested that the isoagglutinin titer of all pools be determined in order to exclude those possessing dangerously high titers of isoagglutinins.

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A CAUTION ON THE USE OF MALEIC ANHYDRIDE AS A REAGENT FOR CONJUGATED DIOLEFINS

ALTHOUGH maleic anhydride is commonly used as a selective reagent for the conjugated diolefins in gasolines and other hydrocarbon mixtures from cracking, it is not generally known that certain dienes fail to respond.

Farmer and Warren[1] early showed that 4-methylpentadiene-1,3 fails to form the expected simple adduct with the anhydride. Since that time other observations reported in the literature indicate that dienes with doubly substituted carbon atoms in the terminal (1,4) positions of a conjugated system RRC = C – C = CRR either give polymeric adducts or, under antioxidation conditions, no appreciable reaction of any kind.

More recently the writer and his coworkers reported that the *cis* isomer of pentadiene-1,3 fails to show significant reaction with maleic anhydride.[2] Since pentadiene-1,3 (piperylene) is the first member in the homologous series of conjugated dienes to exhibit geometrical isomerism, there seems little doubt that analogous isomers of higher dienes will behave similarly, although this has not yet been proved. The writer has also observed in the case of piperylene that the *cis* isomer is much more prominent in mixtures from high temperature processes.

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PYRIDOXIN AND COACERVATES IN PLANT CELLS

PYRIDOXIN may enter into the formation of characteristic aggregates in the vacuoles of senescent or poorly nourished cells which we have recently studied. Free-hand sections of the stems of stunted mustard plants grown without zinc under rigidly controlled conditions show, in the vacuoles of the cells, globular aggregates which have the characteristics of autocomplex "coacervates." A similar phenomenon has been described whereby the phenolic compounds originally distributed at random in the water phase of the vacuolar solution may be condensed into globular aggregates surrounded by lipoids.[1]

Pyridoxin-indophenol may be demonstrated by the Scudi reaction[2] when free-hand sections of tissues are immersed in an alkaline phosphate or, preferably, veronal buffer, in which 2–6 dichloro quinone chloroimide is suspended. Indophenol first forms where pyridoxin exists, within the coacervates; indophenol, being fat soluble, is then absorbed by the lipoid coating the coacervate which it stains blue. The reaction does not occur in a borate buffer where the phenolic group of pyridoxin is known to be masked by the formation of a complex.

We have found *per contra* that in the post-meristematic or the perivascular cells in the roots of mustard or of snapdragon plants grown in a nutrient solution containing zinc and other necessary elements pyridoxin is randomly diffused in the vascuolar solution. It appears to become "coacervated" in the older cells of plants which remain stunted. A healthy condition is probably dependent upon the presence of pyridoxin in the vacuole. Coacervates may therefore inactivate an important constituent of the cell system.

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X-RAY EVIDENCE FOR A THIRD POLYMORPHIC FORM OF SODIUM STEARATE

THE x-ray work of Thiessen and Stauff gave evidence that there are two distinct crystallographic forms of sodium stearate[1] called by them the α and β forms. The authors have discovered a third form[2] which may be called the γ form, in conformity with the notation of Thiessen and Stauff.

The new γ form was detected by noting that it had a unique long spacing. The several spacings assumed to be $d_{(001)}$, are as follows:

Form	Spacing
α	51.8Å
β	46.6Å
γ	44.6Å

[1] Farmer and Warren, *Jour. Chem. Soc.*, 3221, 1931.
[2] Robey, Morrell and Wiese, *Jour. Am. Chem. Soc.*, 63: 627, 1941.

[1] Howard S. Reed and Jean Dufrenoy. *Am. Jour. Bot.*, 29: 544–551, 1942.
[2] J. V. Scudi, H. F. Koones and J. C. Kuesztesy, *Proc. Soc. Exp. Biol. and Med.*, 43: 118, 1940; J. V. Scudi, *Jour. Biol. Chem.*, 139: 707, 1941; O. D. Bird, J. M. Vandenbelt and A. D. Emmett, *Jour. Biol. Chem.*, 142: 317, 1942; J. V. Scudi, R. P. Birks and D. B. Hood, *Jour. Biol. Chem.*, 142: 323, 1942.

[1] *Zeit. Physik. Chemie* (A), 176: 397, 1936.
[2] A. de Bretteville, Jr., Thesis under Dr. J. W. McBain, "X-ray Diffraction Study of Oriented Soaps," Stanford University, 1942.

The γ form is produced when sodium stearate is formed by the reaction between stearic acid (Eastman catalogue number 402) and sodium alcoholate, followed by drying the precipitate at 105° C.

The authors wish to thank R. D. Vold for preparing some of the soap samples used in this investigation.

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J. W. McBain
Stanford University

OCCURRENCES OF "RED WATER" NEAR SAN DIEGO[1]

Since 1917 the Scripps Institution of Oceanography has given considerable attention to the phenomenon of "red water" and to the conditions of its occurrence. Although the information available concerning it is not much greater in detail in 1942 than it was at the time of previous reports,[2] certain aspects of the conditions appear to be growing more distinct.

1942 was characterized by two periods of "red water," although neither was so conspicuous as in one or two former years. The responsible organisms (dinoflagellates) differed at the two periods in 1942 in contrast to the fact that in the other years only one organism attained "red water" prominence in the year in and near La Jolla Bay. *Prorocentrum micans* Ehr. contributed the color in May, but *Goniaulax polyedra* Stein was causative in September. The duration of noticeable discoloration of the sea in May was about one week, in September about three weeks. The largest abundance recorded in May was 500,000 cells per liter, but probably streaks and patches of more than a million per liter were present. In September the numbers in routine catches at the Scripps Institution pier yielded a maximum of 1,000,000 cells per liter, but special catches showed abundances up to about 2,000,000 cells per liter.

In both May and September the conspicuous populations appeared to drift into the bay from the west. In some other years the invasion was from the northwest. However, in all years the evidence available clearly indicates origins outside of the local area. In 1924 the discoloration caused by *Prorocentrum* was first discovered by the institution boat at about ten miles directly off shore and it was not for several days that the appearance was distinct in La Jolla Bay. Differences in direction and speed of approach to La Jolla, considered in connection with the fact that there is no recognizable "nursery area" in the region, indicate rather strongly that growth of these populations to "red water" prominence is dependent upon conditions affecting particular masses of water rather than upon conditions affecting particular localized geographic areas.

Perhaps the most striking evidence concerning occurrences of "red water" acquired by the Scripps Institution in twenty-five years is that indicating zonation of conspicuous abundances. Most of this has come to hand since the institution began intensive operations at sea in 1938. From these and from certain earlier observations off shore, it appears certain that high abundance in Southern California does not occur as much as twenty-five miles from shore (possibly not more than fifteen) and that it does not reach to a depth of more than thirty meters (except in very rare instances). By way of contrast, the planktonic diatoms, which usually thrive under conditions apparently favorable to the planktonic dinoflagellates, have shown large populations far from shore, a hundred miles and more.

Here, of course, we have introduced a nice complexity of problems for marine hydrographers and chemists, etc., no less than for marine biologists. How can we account for such definite zonation with water boundaries of one and not the other of two groups closely associated? Still more difficult, how can we account for the fact that within these zones the "red water" organisms may show little prominence for years and then "suddenly" become conspicuous almost over night? Larger and smaller movements of water masses have a very definite place in the results, as do air conditions also, and there must be a long series of chemical and biological influences to run parallel with these when enormous development of numbers occurs. Until we know more about a number of these things our explanations of occurrences of "red water" must remain rather hazy except for some interesting generalities.

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SCIENTIFIC BOOKS

GROWTH AND FORM

Growth and Form. By D'Arcy Wentworth Thompson. Pp. 1+1116. Cambridge University Press. New edition, 1942. $12.50.

This book, as the author writes in a "Prefatory Note," is a war effort. "I write this book in wartime, and its revision has employed me during another war. It gave me solace and occupation, when service was debarred me by my years. Few are left of the friends who helped me write it, but I do not forget the debt I owe them all." The general character of the work

[1] Contributions from the Scripps Institution of Oceanography, New Series, No. 180.

[2] W. E. Allen, Science, 78: 12–13, 1933; Science, 88: 55–56, 1938.

is shown by the subject-matter of the chapters: Introduction; Magnitude; The rate of growth; On the internal form and structure of the cell; The forms of cells; A note on adsorption; The forms of tissues, or cell aggregates; On concretions, spicules, and spicular skeletons; A parenthetic note on geodesics; The equiangular spiral; Spiral shells of the Foraminifera; The shapes of horns and of teeth or tusks, with a note on torsion; On leaf arrangement, or phyllotaxis; On the shapes of eggs, and of certain other hollow structures; On form and mechanical efficiency; On the theory of transformations, or the comparison of related forms; Epilogue.

There is indeed a continuity of thought in all this strange series of topics, but it comes from mathematics and not from biology. A book of this character and size would be thought to have a profound influence upon biological thinking, but that is not so. An inspection of a series of works upon theoretical biology shows, indeed, only a few references to it, and only rarely is it mentioned at all. How can a work which has cost so much effort have so little effect upon the subject with which it deals, particularly when it is remembered the charm with which it is written? Let us see what statements we can find that will throw any light upon this question.

In his "Epilogue" we find this statement: "For the same reason, with no formal and elaborate conclusion do I bring it to a close. . . . My task is finished if I have been able to shew that certain morphological aspects of morphology, to which as yet the morphologist gives little heed, is interwoven with his problems, conplementary to his descriptive task, and helpful, nay essential, to his proper study and comprehension of Growth and Form. . . . And while I have thought to shew the naturalist how a few mathematical concepts and dynamical principles may help and guide him, I have tried to shew the mathematician a field for his labor—a field which few have entered and no man has explored."

There are two men whom he has in mind here—the naturalist and the mathematician, and of the two it is undoubtedly the latter of whom he is thinking the most. Here is biology, with its many problems, and here is a tool, mathematics, that can solve them. Let us present the case and see what will come of it. And so he takes up one problem after the other and shows us what the application of mathematics does for its solution. But driven as he is with the belief in the possibilities of the mathematician as an explainer of the problems of the biologist, one wonders after all just how convinced he is of the value of this transfer of interest. One encounters every now and then traces of doubt—rarely any firm and unequivocal statements of belief. Thus in the "Introductory" chapter we find these statements: "It is but the slightest adumbration of a dynamical morphology that we can hope to have until the physicist and mathematician shall have made these problems of ours their own. . . . How far even then mathematics will suffice to describe and physics to explain the fabric of the body no man can forsee. It may be that all the laws of energy, and all the properties of matter, and all the chemistry of all the colloids are as powerless to explain the body as they are impotent to comprehend the soul," and then, instead of roundly asserting that this is not so, he mildly adds: "For my part, I think it is not so." He is well aware of the difficulty which the appeal to mathematics makes, for he says: "The introduction of mathematical concepts into natural science has seemed to many men no mere stumbling block, but a very parting of the ways." And in another place he is led to make a statement which raises doubts regarding his own position, for he says: "One does not come by studying living things for a lifetime to suppose that physics and chemistry can account for them all."

There are many other doubts that assail one's mind. One wonders most of all why the entire subject of cytogenetics is left untreated. Surely the significance of all the modern work on this subject must be appreciated, and yet there is no mention of genes and little of chromosomes. Undoubtedly these are of the utmost significance in the determination of growth and form in development. Again, in considering the relation between molecules and the living system there is no reference to supramolecular units, a conception of the greatest significance. Indeed, while the title of the work is "Growth and Form," the act of becoming is only incidentally treated. This the author recognizes, for he states: "My sole purpose is to correlate with mathematical statement and physical law certain of the simple outward phenomena of organic growth and structure, or form, while all the while regarding the fabric of the organism, *ex hypothesi,* as a material and mechanical configuration."

How far it is possible to go, considering only the ill-defined forces in the completed structure, it is difficult to say, but surely it can be asserted with little fear of contradiction that in the present work the author leaves us in the end pretty much where we were in the beginning. But even at that one can not blame the author, for neither in the beginning nor at the end, when all the arguments are made, does he make any definite promises. For us he has outlined a series of

problems in biology, to which he has suggested mathematical solutions and, having done that, he dismisses the whole matter in the hope that some eminent mathematician will be inspired to take advantage of the opportunity to make of biology a true science.

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SPECIAL ARTICLES

PATHWAY OF INVASION IN A CYNOMOLGUS MONKEY AFTER ORAL APPLICATION OF POLIOMYELITIS VIRUS[1]

Despite a great deal of work on both human and experimental material, the portal or portals of entry of poliomyelitis through the body surfaces has not as yet been precisely determined. Present evidence shows that the olfactory system is not as a rule primarily implicated, and that invasion probably occurs in most cases through the alimentary tract, but it is not yet known whether the upper portion—the mouth and pharynx—or the lower portion—the stomach and intestines—is the more vulnerable to penetration by virus.

In studying this problem we have encountered certain technical difficulties which have apparently prevented others also from obtaining a clear answer. Among these may be mentioned the difficulty of confining the application of virus in the experimental animal to a particular region of the alimentary tract; and the difficulty, in cases of fully developed infection, of determining the portal of entry from the distribution of virus or of lesions in the central nervous system. The latter procedure appears to be better adapted to the exclusion of a given portal than to its positive determination, because, once virus has become implanted and the animal has developed typical symptoms of the disease its spread is remarkably rapid and extensive, even before paralysis has occurred.

It has become clear to us that the experimental animal must be sacrificed at the earliest possible moment of manifest infection or even before this, in order to obtain plain evidence of the primary localization. However, the adoption of routine and systematic examination of the peripheral nervous ganglia—suggested by McClure's recent work[2]—has proved to be helpful, a method the value and significance of which has been surprisingly late in gaining recognition. These ganglia contain the nerve cells whose axons supply the mucous surfaces through which the virus presumably first gains access to the interior of the body and it is highly probable that they are the primary site of multiplication of this strictly neuronotropic virus. Since most of the ganglia (with the exception of those of the vagus) supply a fairly limited portion of the mucous surfaces, the distribution of lesions or of virus in them should afford valuable clues to the portal of entry, provided as we have stated that the examination is made early in the disease. Particularly significant ganglia are the Gasserian, the geniculate and the petrosal, which supply the mucous membrances of the mouth and nasopharynx, and the celiac, which supplies the stomach and intestine. The sympathetic and spinal ganglia also have some localizing value, but the vagus ganglia (nodose and jugular) have such wide-spread connections in the entire alimentary and respiratory tracts as to give but little localizing information.

Using cynomolgus monkeys and Sabin's *Per* strain of poliomyelitis virus, we have applied virus to various parts of the alimentary tract and have killed animals shortly after the onset of fever or, in some cases, without any signs of infection. Tissues of the central and peripheral nervous system have been systematically examined for lesions, including the olfactory bulbs, brain stem and spinal cord; the ganglia of the V, VII (geniculate), IX, X cranial nerves; the sympathetic ganglia of the ganglionated cord at all levels; the spinal ganglia at all levels, and the celiac plexus. The results of the study as a whole will be reported later, but at this time we wish to present the data in one monkey as being of some special interest.

Cynomolgus 9. Capsules, covered with a digestible fat, containing dried virus amounting to about one third of a cynomolgus cord, were inserted into the esophagus on April 5, 1941, in such a manner as to avoid contamination of the mouth. On May 20 and again on September 15, 1941, after zinc sulfate olfactory blockade, the tongue was gently swabbed with a minute amount of 15 per cent. virus suspension. On January 22, 1942, a high enema of 5 cc of 20 per cent. virus suspension was administered. No symptoms and no fever occurred after any of these treatments. The olfactory mucosa was again treated with zinc sulfate on March 14, 1942, and on March 25 and on each of the 3 following days, the mouth was sprayed from an atomizer with 5 cc of a 10 per cent. suspension supernate. On March 30, 5 days after the first spraying, fever, slight weakness of the arms and mild head tremors were noted at 5 P.M. (none of these had been present that morning). It is highly probable that this animal would have become paralyzed. It was sacrificed about 15 minutes later, following our routine

[1] From the Department of Pediatrics, Stanford University School of Medicine, San Francisco, Calif. Sponsored by the National Foundation for Infantile Paralysis, Inc.
[2] G. Y. McClure, Science, 94: 307, 1941.

procedure of etherization, exsanguination, perfusion with physiological saline solution and 10 per cent. formalin. The nervous tissues were stained with gallocyanin and eosin according to Einarson's method.

Serial sections were made of the olfactory bulbs and peripheral ganglia. Sections of the brain stem were taken at intervals of 0.6 mm and of the spinal cord from upper, middle and lower portions of the cervical, thoracic and lumbar regions (3–4 successive sections, 20 micra thick from each). Lesions[3] in the ganglia consisted of small cell infiltrations, chromatolysis, neuronal necrosis and neuronophagia; in the brain stem, mainly of perivascular infiltrations with occasional parenchymal infiltration. Heavy lesions were found in both Gasserian ganglia and both nodose (X nerve) ganglia. Moderately severe lesions were found in both petrosal (IX nerve) ganglia, in 3 of 6 cervical sympathetic ganglia and 2 of 10 upper thoracic ganglia. Small lesions, few in number, were found in one geniculate (VII nerve) ganglion; in 1 lumbar sympathetic ganglion and in 2 of 14 thoracic spinal ganglia. In the medulla a few typical parenchymal and perivascular infiltrations, without definite cell necrosis, were found in and near the nucleus of the tractus solitarius but nowhere else. No lesions were found elsewhere in the brain stem, in the olfactory bulbs, the lower thoracic sympathetics, the celiac, the cervical spinal or the lumbar spinal ganglia or in the spinal cord.

With the exception of the few very slight lesions in one lumbar sympathetic ganglion (which may have resulted from inapparent infection from the earlier virus enema), it would appear that the lesions found can all be explained on the basis of nerve-borne infection entering through the mouth, mainly through the fibers of the fifth, ninth and tenth nerves (probably including the gustatory), and to a lesser extent through the sympathetics; and it is evident that infection had just begun to invade the central nervous system from its primary neuronal site of multiplication through the central connections of the IX and X cranial nerves in the nucleus of the tractus solitarius in the medulla. It is interesting to note that although the Gasserian ganglia were heavily involved, their central connections contained no lesions. The dorsal motor nucleus of the X nerve likewise was uninvolved.

The experiment is of special interest because it demonstrates entry of virus through the mouth and pharynx after oral administration, and also the mode of progression of infection from the exterior mucous surfaces to the local peripheral nervous system into the central nervous system. It would appear that the mouth and pharynx are readily vulnerable to penetration by this virus. We are far from wishing to use this experiment or others like it as evidence in exclusion of other possible portals, such as the lower alimentary tract. Indeed, we have some positive evidence that infection can also enter via the latter. However, it may be pertinent to note that the very frequent occurrence of headache, vomiting, nuchal pain and other symptoms in the preparalytic stage of the human disease strongly suggest early involvement of the brainstem, particularly the medulla, which is better accounted for by entry from the oropharyngeal passages than from the more distant intestines. It has too generally been assumed that bulbar paralysis is the sole criterion of primary bulbar poliomyelitis. Primary involvement of the afferent centers is, in our opinion, of at least equal importance and possibly more common. The reason why bulbar motor involvement is frequent after adenotonsillectomy is probably that infection is traumatically introduced into the motor nerves of the pharynx and so conducted directly to their motor nuclei. In the ordinary case, in which deep trauma is not a factor, infection entering through the oropharyngeal membranes would rather invade the afferent nerves into the peripheral ganglia and thence into the sensory bulbar centers, whence it could progress to other centers but without necessarily involving the motor nuclei of the medulla. Experimentally, it has been thoroughly proven that, following olfactory and intracerebral inoculation, poliomyelitic infection can pass freely down through the medulla into the spinal cord and produce spinal paralysis without accompanying bulbar paralysis.

Since poliomyelitis is probably acquired as a rule by the alimentary route, the oropharyngeal mucosa is obviously the first site of contact with virus in contaminated food and drink and on fingers, which children so often put in the mouth. Here the contacts of the virus with the mucous surfaces are immediate and the virus is at its maximum concentration. In the stomach and upper intestine, dilution by secretions and destruction by acid and proteolytic enzymes may to some extent protect the body against infection. In the present experiment the failure of large amounts

[3] In one control cynomolgus monkey fairly numerous infiltrative lesions were found in several of the peripheral ganglia. This animal had been kept for over 10 months in the same animal room with others that had been freely exposed to virus by enema, etc. The lesions resembled in all respects those found in animals treated with poliomyelitis virus. While it is possible and perhaps probable that this was an instance of "spontaneous" poliomyelitis infection, one must be guarded in concluding that lesions in the ganglia are necessarily due to poliomyelitis and not to some other neurotropic virus. In the present instance the prompt sequence of infection after mouth exposure, to poliomyelitis virus, the localizations of the lesions and the typical early lesions in the medulla are believed to make the diagnosis of poliomyelitis reasonably secure. McClure (personal communication) has also found lesions in the peripheral ganglia in rhesus monkeys not directly treated with poliomyelitic material.

of virus to infect the same animal when previously administered by stomach without mouth contamination gives some support to such a concept.

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A VIRUS OBTAINED FROM A PNEUMONIA OF CATS AND ITS POSSIBLE RELATION TO THE CAUSE OF ATYPICAL PNEUMONIA IN MAN

A RESPIRATORY tract infection in cats—variously called nasal catarrh, influenza or distemper—has been observed frequently within the past year or so in the Northeastern United States. The main characteristics of the disease are its highly infectious nature, debilitating effects and long course of about a month. Its respiratory nature is recognized by sneezing and coughing, which is accompanied by a mucopurulent discharge from the eyes and nose. The existence of a pneumonia is not determined by the usual clinical examination unless the animal is markedly affected, but an autopsy reveals grayish, densely consolidated areas in the anterior lobes of the lungs.

Suspensions of lungs from cats showing typical clinical symptoms and pneumonia were inoculated intranasally into mice. The mice became sick in the first passage, and those inoculated with two of the strains died in 3 to 5 days. In another attempt to isolate the agent, the mice appeared sick but survived the inoculation. At autopsy all inoculated mice presented a definite pneumonia with more than half the lung substance consolidated. Serial passage reduced the time interval to a point where death occurred in 2 to 3 days following the intranasal inoculation of a 10 per cent. suspension of infected lungs. Similar serial passages from uninoculated mice from the same source were entirely negative.

The agent was easily transferred to eggs, which had been incubated for 5 days, by inoculation into the yolk sac. The embryos died consistently within 2 to 3 days in serial passage, even when relatively large amounts of infectious material were inoculated.

When suspensions of lungs of inoculated mice or of yolk sac membranes of inoculated eggs were given intranasally to normal kittens the typical disease was produced. From these inoculated cats the disease went by contact to normal kittens.

Cultures from the lungs of naturally infected cats and of infected mice showed few bacteria and were frequently negative. All attempts failed to demonstrate a cultivable agent from infected eggs on blood agar plates and on a variety of special media designed for the culture of anaerobes and pleuropneumonia-like forms. These findings suggest that the agent is a virus, yet attempts to pass the agent through Berkefeld filters gave irregular results. The nature of the agent, however, became apparent when sections of the yolk sac membrane stained with Giemsa, or films from lungs of mice or yolk sac membrane treated by Machiavello's method, revealed numerous elementary bodies similar to those of psittacosis.

Centrifugation of infected mouse lungs and yolk sac suspensions at 10,000 r.p.m. for 30 minutes removed much of the infective agent from the supernatants and concentrated it in the sediments. This is added evidence that the observed elementary bodies are the etiological agent.

A number of instances of contact between sick cats and people who subsequently developed atypical pneumonia have been brought to our attention. For example, Dr. Francis G. Blake (personal communication), of Yale University, observed an atypical pneumonia in a rural family in Connecticut which occurred where cats were sick with a pneumonia. Dr. C. W. Barber, of the New York State Veterinary College, noted the reverse, where a child sick with atypical pneumonia played with a kitten that later became sick. It may be of epidemiological interest that the disease in man and in cats is occurring simultaneously.

Complement fixation tests have been made, using antigens of partially purified and concentrated elementary bodies prepared from infected mouse lungs. Sera obtained from cats before infection and again after they had recovered were tested. All the 6 cat sera obtained before infection failed to fix complement when 0.1 cc or less was mixed with 0.1 cc of the antigens. Using the same amount of antigen and testing at the same time, the convalescent cat sera fixed complement when from 0.02 to 0.0025 cc was used. Five sera drawn from man during the acute and convalescent stages of atypical pneumonia were obtained from Miss Catherine Grenci and Dr. Norman Moore, Cornell Infirmary, Ithaca, New York, and 7 more similar sera from Dr. Frank Horsfall, of the Hospital of the Rockefeller Institute. Eight of these sera drawn during the acute illness fixed complement; and the convalescent sera from 5 of these cases showed a definite increase in this property, while 3 showed a questionable increase and 4 no increase.

Sera from 9 presumably normal individuals were examined for controls. 0.1 cc of 2 specimens failed to fix complement, while the same amount of 4 others fixed more or less completely; 2 specimens fixed with 0.05 cc and 1 with 0.025 cc. As controls in this test, one serum drawn during the acute stage of the disease fixed in an amount of 0.0125 cc, while the convalescent serum fixed in ¼ this amount, or 0.0031 cc. Another serum drawn during the acute stage failed to fix when 0.1 cc was used, whereas 0.0125 cc of the convalescent serum fixed.

SUMMARY

Evidence is produced that a respiratory disease in cats is due to a virus that forms elementary bodies and that this virus is the same as or closely related to the one causing some of the so-called atypical pneumonias in man. Further work is in progress, and a detailed report of the cat disease and of additional complement fixation tests will be made later.

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CAPILLARY EMBOLI AS A LETHAL FACTOR IN BURNS[1]

IN the course of an extensive series of experiments on shock following thermal trauma in anesthetized cats,[2] it was noted that a small proportion of the animals succumbed with extreme rapidity within a few minutes of burning. In these cases, respiration stopped suddenly, the heart was slow and irregular and the blood pressure fell precipitately. Artificial respiration usually did not result in recovery, although the heart continued to beat for some time. Hemoconcentration and local fluid loss into the area of the burn were minimal at the time of death. Necropsy in these cats showed pulmonary congestion, subendocardial hemorrhages in the left ventricle and in one instance punctate hemorrhages in the liver and submucous hemorrhages in the duodenum.

Since the sudden death in these experiments could not be explained on the basis of loss of fluid and since the nervous factor had been eliminated experimentally,[2] the phenomenon was attributed to a toxin. The investigation was carried forward to study the possibility that changes produced by heat in the circulating blood could account for rapid death from burns.

Measurements of subcutaneous temperature in experimental scalds[3] show that temperatures of 55 to 65 degrees C. are reached and maintained for several minutes. Citrated cat's blood was heated to 65° C. (149° F.) for one minute; it remained fluid but became dark in color and showed evident hemolysis. Heating of plasma to 56°–65° C. resulted in the formation of a voluminous fine precipitate, presumably fibrinogen. On the other hand, when serum was treated in the same way, no visible change was evident. Fresh coagulable blood heated quickly to 65° C. remained fluid and became incoagulable.

After heating a small amount of citrated cat blood for one minute to 65° C., reinjection intravenously into the same animal resulted in rapid death. This reaction was similar to the rapid deaths observed following burns. Blood pressure fell markedly and respiration ceased within one to two minutes, but the heart continued to beat for 5 to 10 minutes and artificial respiration was of no avail. As little as 3 to 4 cc of heated blood injected rapidly produced this characteristic fatal outcome. The same phenomenon has been observed repeatedly in cats under nembutal following rapid intravenous injection of 1 to 2 cc of autogenous plasma previously heated to 65° C. for one minute. Intravenous injection of heated serum in much larger amounts had no significant effect. The supernatant of centrifuged heated plasma was also ineffective, indicating that it is the fine precipitate of fibrinogen in heated plasma which possesses the toxic properties.

By very slow intravenous injection of heated plasma, much larger amounts could be introduced without producing rapid death. In one experiment, after injection of 13 cc of heated plasma, blood pressure was low for an hour and respiration became rapid and shallow. The cat survived for four days, during which time it was very weak and unresponsive and made no spontaneous movements. Necropsy showed marked congestion of the lungs, slight renal congestion, a discolored dark gray and softened liver and a gastric ulcer one cm in diameter which had perforated.

The experiments were then extended to study the effect of intravenous injection of heated human plasma and serum into unanesthetized rabbits. Human plasma heated to 56° to 65° C. showed a precipitate similar to that observed in heated cat plasma, while heated human serum was apparently unchanged. Rapid injection through a 22 gauge needle of 2 to 5 cc of heated human plasma into the ear vein of rabbits resulted in rapid arrest of respiration followed by anoxic convulsions with occasional gasping. The heart continued to beat for some time, but artificial respiration was ineffective. All the rabbits injected with heated plasma died within 5 to 10 minutes. The centrifuged precipitate of heated human plasma gave the same reaction, while intravenous injection of as much as 40 cc of the supernatant or of unheated human plasma had no effect. Intraperitoneal injection of heated human plasma was also ineffective. Rapid intravenous injection of heated human serum in amounts up to 40 cc was likewise innocuous to the rabbits.

Necropsy of rabbits which died from injection of heated human plasma or precipitate showed no gross pathology in the internal organs or in the brain other than occasional slight pulmonary congestion. Microscopic examination of the lungs revealed wide-spread and numerous capillary protein emboli.

[1] Aided by a grant from the Graduate School of the University of Minnesota.

[2] H. Kabat and R. F. Hedin, *Surgery*, 11: 766–776, 1942.

[3] H. Pfeiffer, *Virchow's Arch. f. path. Anat.*, 180: 367, 1905.

The precipitate from heated human plasma (presumably fibrinogen) was rendered innocuous simply by homogenizing it in an apparatus capable of breaking up tissue cells. Rapid intravenous injection of 40 cc of the homogenized suspension of the precipitate had no toxic effect on rabbits. This demonstrates conclusively that it is the particle size rather than the chemical constitution of this material which bears the toxic properties.

There is a distinct possibility that capillary emboli may play a role in the constitutional effects of severe burns. Many of the older investigators on pathogenesis of shock and toxemia in burns considered this possibility. Frankel[4] noted minute capillary thrombi in the liver, spleen and kidneys in burn cases, and Bardeen[5] reported that capillary thrombosis in the liver was not infrequent following burns. Billroth[6] and others supported the embolic theory of the etiology of Curling's ulcer. In experimental burns, Salvioli[7] found that previous defibrination of the blood rendered dogs more resistant to burns. He showed that warming of the mesentery to 55° C. caused adherence of platelets to the walls of small vessels and formation of minute thrombi. Vaccarezza[8] observed hypocoagulability of the blood following burns in dogs.

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[4] E. Frankel, *Deutsche med. Wchnschr.*, 15: 22, 1889.

[5] C. R. Bardeen, *Johns Hopkins Hosp. Rep.*, 7: 137, 1898.

[6] T. Billroth, *Wien med. Wchnschr.*, 17: 705, 1867.

[7] J. Salvioli, *Virchow's Arch. f. path. Anat.*, 125: 364, 1891.

[8] R. A. Vaccarezza, *Comp. rend. Soc. de Biol.*, 86: 1114, 1922.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE METHOD FOR RAPID TUBE FEEDING OF RATS[1]

Our attempts to forcibly feed rats have developed a method permitting one person to feed rats rapidly without recourse to expedients such as gags,[2, 3] holding the tongue,[4] wrapping the animal in towels[5] or clipping the teeth.[6] The method is described here in the hope that it will prove of value to others confronted with this problem.

The equipment required is: (1) a syringe of appropriate size; (2) a 7-inch piece of soft rubber catheter tubing (No. 8 Fr.), one end being cut square and the other beveled; (3) an adapter made by soldering a piece of brass tubing (1 cm long, 2 mm o.d.) to the hub of an old hypodermic needle and inserted into the square-cut end of the catheter tube; (4) a ring stand and burette clamp; (5) a piece of heavy string about 30 inches long having a large securely tied loop at each end.

The feeding is done as follows: The syringe is filled with the desired quantity of the liquid food mixture and is securely clamped to the ring stand in a horizontal position by means of the burette clamp. The rat is grasped in the left hand with the thumb and index fingers about the shoulders and the left foreleg held between the index and middle fingers. The right foreleg is supported by the thumb. With the rat in a vertical position facing the operator, one loop of the string is caught over the upper incisors, the string is passed over the back of the left hand and between the fourth and little fingers and is fastened by winding it several times about the latter. The tension on the string should be sufficient to hold the head of the animal securely against the palm of the hand. The other loop of the string is now caught over the lower incisors, passed down over the back of the thumb, and fastened by winding around the middle and fourth fingers of the left hand. Tension should be sufficient to hold open the animal's mouth, the extent of opening being controlled by pulling apart the thumb and index fingers which respectively increase the tension on the lower and upper jaws of the animal. The rat is thus effectively suspended by the two strings attached to its jaws. Undue pressure can not be exerted on the animal, for, in order to hold it securely, the thumb and index fingers must be held apart.

With the animal in a vertical position and resting its hind feet on the operator's chest, the wetted tube is inserted into the esophagus with a downward rotating motion. Using a soft rubber tube we have not once, in the course of several thousand feedings, inserted the tube into the trachea. When the tube is pushed down sufficiently (depending on the size of the rat), the adapter is firmly attached to the syringe and the contents of the latter are slowly forced through the tube. The tube is withdrawn and the string attached to the lower jaw is unwound from the fingers.

[1] Aided by a grant from the Rockefeller Foundation and administered by Dr. P. E. Smith.

[2] R. M. Reinecke, H. A. Ball and L. T. Samuels, *Proc. Soc. Exp. Biol. and Med.*, 41: 44, 1939.

[3] C. S. Mathews, E. L. Schwabe and F. E. Emery, *Jour. Lab. and Clin. Med.*, 27: 352, 1941.

[4] A. E. Pugh and A. W. Tandy, *Jour. Lab. and Clin. Med.*, 24: 80, 1938.

[5] D. J. Ingle, Personal communication.

[6] R. M. Reinecke and L. T. Samuels, *Endocrinology*, 30: 687, 1942.

The animal is placed on the table in an upright position and the loop holding the upper teeth flicked off in a single motion. The syringe and tube are rinsed with water and are ready for the next animal.

After short training a single operator can feed 30 to 40 animals per hour. Regurgitation or leakage up the esophagus is never encountered. By the use of this method we have supplied normal and hypophysectomized rats of all ages, beginning at 35 days, with their entire food supply for long periods with excellent results.

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COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY

THE USE OF CREOSOTE IN MOUNTING FLEAS AND OTHER ARTHROPODS ON SLIDES

To study the classification of fleas properly, it is necessary that unsclerotized structures and intestinal contents be cleared or dissolved away so as to expose the taxonomically important terminalia. In general, the procedures used to accomplish this end are long and tedious. It is usually considered necessary to treat the material with potassium hydroxide, dehydrate in several changes of alcohol and clear in xylol before mounting in balsam. The technique of C. Fox[1] makes eight treatments necessary before the flea is ready for study, while that published by the writer[2] in 1940 involves six steps, which is but a slight saving in time and trouble.

In an effort to discover a method of preparation which would dispense with potassium hydroxide, and the necessity for dehydrating and clearing in separate processes, experiments were made with cedar oil, clove oil, beechwood creosote and wood creosote. It was soon discovered that the best of these reagents for this purpose is wood creosote. Creosote not only clears the soft parts and intestinal contents to a satisfactory degree, but also prepares the specimen for mounting in balsam. No other reagent is necessary. The flea may be removed from any degree of alcohol or even from water and placed in creosote for 24 hours. Thereafter it is ready for mounting in balsam. Both the creosote U.S.P. from wood tar and the creosote U.S.P. from beechwood were satisfactory.

The chief advantage to this method of preparing fleas is the convenience of having to use but a single reagent. There are other advantages, however, to the use of creosote instead of KOH. It frequently happens in the use of KOH that important taxonomic characters are distorted, the setae are loosened and lost, and in general much destruction of parts inflicted. These things do not happen where creosote is used, and it is the writer's opinion that a much better mount is obtained, since sufficient clearing is accomplished without the violent action of a caustic. A disadvantage to the use of creosote is its slightly irritating effects to the human skin and the objectionable odor, but the writer does not regard these as annoying to a prohibitive degree.

This simple process has proved a boon not only as regards research in the taxonomy of fleas, but also in preparing material for use by large classes in entomology. Thrips, Collembola, mites, immature stages of Diptera, and insect organs, such as honeybee stings, mouthparts, etc., have been prepared quickly and easily by simply dropping the material in creosote and mounting in balsam after 24 hours. Where the integument is rather delicate, as in the case of some Collembola, it is preferable to "cut" the creosote with equal parts of absolute alcohol. The process should not be used, however, where the integument is very delicate or where it is desirable to retain the coloration.

IRVING FOX

UNIVERSITY OF PUERTO RICO, RIO PIEDRAS, PUERTO RICO

[1] Carroll Fox, "Insects and Disease of Man," p. 221. Philadelphia, Pa., 1925.

[2] Irving Fox, "Fleas of Eastern United States," p. 2. Ames, Iowa, 1940.

BOOKS RECEIVED

BILLINGS, MARLAND P. *Structural Geology.* Illustrated. Pp. xi + 473. Prentice-Hall, Inc. $4.50.

BLAIR, THOMAS A. *Climatology: General and Regional.* Pp. xvi + 484. Prentice-Hall, Inc. $5.00.

BURROWS, J. AUSTIN, PAUL ARTHUR and OTTO M. SMITH. *Semimicro Laboratory Exercises in General Chemistry.* Pp. xiii + 328. Macmillan. $2.50.

DEGERING, ED. F. and COLLABORATORS. *An Outline of Organic Chemistry.* Revised. Pp. xi + 386. Barnes and Noble, Inc. $1.25; *An Outline of Organic Nitrogen Compounds.* Pp. 381. John S. Swift Company, Inc.; *The Quadri-Service Manual of Organic Chemistry.* Pp. 221. Houghton Mifflin Company. $2.50; *The Work Book of Fundamental Organic Chemistry.* Pp. 256. Barnes and Noble, Inc. $1.25.

EVANS, WILLIAM LLOYD, JESSE ERWIN DAY and ALFRED BENJAMIN GARRETT. *An Elementary Course in Qualitative Analysis.* New edition. Pp. 239. Ginn and Company. $2.25.

GARRETT, ALFRED BENJAMIN, LAURENCE LARKIN QUILL and FRANK HENRY VERHOEK. *Introductory Chemistry for the Laboratory.* Pp. 239. Ginn and Company. $1.60.

GOLDSTEIN, KURT. *Aftereffects of Brain Injuries in War.* Pp. 244. Grune and Stratton. $4.00.

LANG, EDWARD H. *Technical Handbook for Solving Problems in Shop or Factory.* Pp. ix + 100. Prentice-Hall, Inc. $1.00.

MEES, C. E. KENNETH. *The Theory of the Photographic Process.* Illustrated. Pp. x + 1124. Macmillan. $12.00.

RUKEYSER, MURIEL. *Willard Gibbs, American Genius.* Pp. xi + 465. Doubleday, Doran and Company, Inc. $3.50.

SPILHAUS, ATHELSTAN F. and JAMES E. MILLER. *Workbook in Meteorology.* Pp. ix + 163. McGraw-Hill. With charts, $3.00.

WILLKIE, HERMAN FREDERICK and PAUL JOHN KOLACHOV. *Food for Thought.* Illustrated. Pp. 209. Indiana Farm Bureau, Inc., Indianapolis. $2.00.

SCIENCE NEWS

Science Service, Washington, D. C.

DISCOVERY OF NOVA PUPPIS

A NEW star or nova brighter than all but ten stars in all the heavens has burst forth and may be seen in the early morning sky. It is somewhat brighter than first magnitude. This is the brightest nova since 1918 and is the most striking and unexpected of astronomical events.

Discovered by an American astronomer in Argentina, the brilliant new star will be known as Nova Puppis, because it is located in the constellation of Puppis, meaning the stern of the ship.

It may become known as this year's Christmas star because one of the explanations of the star of Bethlehem is that it was such a nova.

The new star was discovered the past week end by Bernhard H. Dawson, of the University Observatory at La Plata, Argentina. He is an American astronomer, born and educated in Michigan. News of the discovery was received at Harvard Observatory in the form of a brief telegram signed by Enrique Gaviola, director of the Argentine National Observatory at Cordoba, Argentina.

The constellation Puppis, in which the nova is located, is in the southern sky, rising about 2: 00 A.M. during November and crossing the meridian about 5: 00 in the morning. The nova is situated near the second magnitude star Zeta Puppis, sometimes called Naos.

But the nova, according to Leon Campbell, recorder of the American Association of Variable Star Observers, outshines all stars in its vicinity, for on the morning of Armistice Day it was of magnitude -0.8 (minus zero point eight) which makes it brighter at present than the star Altair in the eagle.

Those who can find Sirius can easily find the new star. Sirius, brightest star in the sky, rises after midnight in the southeast. An hour and a half later Nova Puppis rises, but much farther to the south. Sirius is in Canis Major, the constellation of the big dog, the southern part of which is a triangle of three second magnitude stars. A line from Sirius through the triangle prolonged about its own length will end near the nova.

Not since 1918 has a star of the first magnitude blazed forth. In that year it was during the eclipse of the sun in June that a nova was discovered in the daytime sky.

The nova now in the skies may remain at its peak brightness for several weeks, or it may decline rapidly. Its behavior can not be predicted exactly. Meanwhile, it alters the appearance of the sky in its vicinity greatly.

Only 20 stars in the whole sky are of the first magnitude. Thus, this star takes its place among the first 20; in fact, it is now the eleventh brightest star in the entire sky and the seventh brightest to be seen from Washington's latitude. It may even get brighter, but usually novae are not seen much before their maximum brightness.

Astronomers will check the position of the nova with those of stars on earlier photographs of the same region to determine which of the faint stars in this part of the milky way suddenly flared up so bright. Novae are not really new at all, but old stars which suddenly increase in brightness hundreds of thousands of times.

Nova Cygni, reported earlier by Science Service this year, reached only the eighth magnitude. Nova Puppis is about six hundred times as bright as this was, and Nova Cygni has now faded to the 15th magnitude.

The first glimpse of Nova Puppis was obtained by Dr. Edison Pettit, of the Mount Wilson Observatory, on the morning of November 10. This was an independent discovery of the nova, first report of which came from Argentina.

Dr. Pettit, who specializes in observations of the sun and not the stars, sighted the nova by accident and not during the course of regular astronomical work. He immediately checked its position with a 6-inch telescope in his backyard observatory. A photometer happened to be attached to the instrument so that he was able to make an accurate measurement of the nova's brightness. It was then about as bright as Rigel, the brightest in the constellation of Orion, just north of the nova.

The star was seen too late to photograph at the observatory on Mount Wilson that morning, but preparations were made during the day and many photographs of the spectrum of the nova were taken at the 100-inch telescope the following morning. The nova is too far south to observe with the 60-inch telescope on Mount Wilson.

On the morning of Thursday, November 12, astronomers estimated the nova was still of the first magnitude.

SPECTRUM OF NOVA PUPPIS

NOVA PUPPIS is now in the midst of its most violent phase of ejection of gas, is indicated by observations of its spectrum by Dr. A. D. Maxwell and Dr. Dean B. McLaughlin, of the University of Michigan Observatory. This may mean that the brilliant star will become even brighter before it begins a decline in light which will finally return it to stellar oblivion. Already it is surpassed by only ten stars in the whole sky.

The Michigan spectra show strong interstellar calcium lines and allow estimates that the distance of the nova is such that it took light 1,600 years (traveling 186,000 miles per second) to reach earth and that the actual brilliance of the star is 150,000 times that of our sun.

Dr. Maxwell discovered the new star independently on Armistice Day morning before news of its discovery in Argentina had been received. It was then too late to take photographs of its spectrum. The next morning Drs. Maxwell and McLaughlin took successful spectrographs despite the difficulty of observations because the star is low in the southern sky.

The star's spectrum shows strong hazy bright hydrogen bands, conspicuous bright ionized iron and a neutral oxygen band at 6155, with their centers undisplaced. These are bordered on the edges of shorter wavelength by diffuse absorption lines. Absorptions of ionized titanium, magnesium and silicon are also present. No traces are seen of helium or other "hot star" lines. Displacements of absorption lines are discordant. Hydrogen is shifted the equivalent of a motion of 1,100 kilometers (700 miles) per second toward the earth, iron and titanium about 900

kilometers (550 miles) per second and magnesium somewhat less.

THE SUPPLY OF PHYSICIANS

"Business as usual" is out for the private physician and the health officer just as it is for industrial concerns and small manufacturers and dealers, according to a statement made by Dr. Thomas Parran, Surgeon General of the U. S. Public Health Service, at the Richmond meeting of the Southern Medical Association.

Even if available medical services are rationed under National Service legislation, as has been proposed and discussed in recent weeks, great efforts must be made to increase the supply of personnel. This means keeping enough physicians in medical schools to teach and train more students. Medical students and, if the draft age is lowered, premedical students could, he suggested, be enrolled as a special category of professional manpower and, upon completion of internship, allocated among the Army, Navy and civilian services.

"This," he said, "would eliminate the present uneconomical procedure under which the Army and the Navy compete for medical students by commissioning them in numbers which may later prove disproportionate to the needs of the respective services. Much depends now and more will depend after the war upon a continuing flow of young, able-bodied physicians of the highest caliber."

The Medical and Health Committee has recently approved a plan for increasing the number of graduate nurses and meeting the growing deficiency in hospital nursing services. The plan calls for speeding up the basic training course for completion in twenty-four months, after which third-year students would go on the payroll of the parent hospital or affiliated institutions. They would live outside the hospital, thus leaving dormitory and classroom space for more students. They would not receive their certificates until after three years of training, but their release in the last year would supply civilian hospitals with replacements for the general duty nurses who have been drawn into war service. The physical facilities for nurse training would be increased by a third and hospitals would be provided with an augmented staff for war duty.

The difficult task of supplying medical services in critical areas now lacking them can best be handled one by one. Following this thought, plans for meeting needs in different communities will be worked out individually. Such plans are now being made by the Procurement and Assignment Service and the Public Health Service.

INVENTIONS OF WORKERS IN THE U. S. DEPARTMENT OF AGRICULTURE

Sugar from sorghum, fireproofing, better insecticides and over 50 other inventions have been developed by workers in the U. S. Department of Agriculture in the past year. Most of the devices were developed to increase farm efficiency, officials stated, but many will have direct importance to every one in meeting wartime needs.

Sugar yield from sorghum comparable with that obtained from sugar cane, for example, will now be possible for the first time. The process was patented by Emil K. Ventre and Howard B. Paine, of the Agricultural Research Administration.

Establishment of an industry to relieve the sugar shortage will result, it is hoped, from research to develop improved sorghum varieties. Some varieties of high sugar content mature early enough, it is pointed out, so that sugar factories could process the sorghum before the sugar-cane harvest, using the same equipment.

An improved insecticide has been developed by Samson R. Dutky, of the Agricultural Research Administration, for combatting the Japanese beetle, a destructive insect in many areas. The new insecticide consists of an inert powder mixed with large numbers of germ spores which produce a milky disease fatal to the larvae.

A trap for moths of the tobacco and tomato worms, developed by Lincoln B. Scott and Joe Milam, of the Bureau of Entomology and Plant Quarantine, is another device for insect control.

A method for checking the development of rancidity in oils and fats, a process which increases the resistance of nails to withdrawal from wood, and a chemical preparation for fireproofing fabrics are covered by other patents.

Of the inventions listed by the Department of Agriculture, about half were dedicated to the public and the remainder were assigned to concerns for development, with control retained by the department.

ITEMS

Visitors to the American Museum of Natural History can get a glimpse of what life on Guadalcanal was like in more peaceful times, in a new habitat group showing typical birds of that remote but now familiar island. The exhibit is one of four showing birds and their homes in South Pacific islands, collected by a scientific expedition four years ago, under the leadership of the late Lieutenant A. B. Fahnestock and his brother, Captain J. S. Fahnestock. Among the strangest of the birds shown are the brush fowl, which buries its eggs in a mass of fermenting dead leaves which act as a natural incubator; and the dwarf climbing parrot, a little bird no bigger than a sparrow, that climbs trees like a woodpecker and makes its home in the nest of termites which appear to be its principal food.

Rotenone, needed in our unending defense against insects, is an essential ingredient in fly sprays and other insecticides. It is extracted from the roots of certain tropical plants of the bean family, that grow both in southeast Asia and in the Amazon basin of South America. Before the war, we used to get a large part of our requirements from Malaya and the East Indies, the rest from South America. Now the two South American nations are coming to the rescue by greatly increasing their exports. The rotenone-bearing roots will be supplied through regular trade channels and the Commodity Credit Corporation will act as sole purchaser for the United States, paying agreed-on prices.

NEW BOOK AND INSTRUMENT CATALOGUES

ARGOSY BOOK STORES, New York. *Americana.* Pp. 63. *Books for Scholars.* Pp. 63.

BOOK SUPPLY CO., THE, Chicago. *1943 Illustrated Catalog.* Pp. 321.

CHEMICAL PUBLISHING CO., INC., Brooklyn, N. Y. *Technical Books on All Subjects—1942–1943.* Pp. 64.

CHICAGO APPARATUS COMPANY, Chicago. *The Milvay Notebook.* Pp. 32. Illustrated.

LEEDS & NORTHRUP COMPANY, Philadelphia. *Micromax—Thermocouple Pyrometers for Measurement and Control.* Pp. 57. Illustrated.

NATIONAL BOOK COUNCIL, London, W.C.2, England. *British Book News—July, 1942.* Pp. 12.

QUARITCH, BERNARD, LTD., London, W.1, England. *A Catalogue of Books & Periodicals on Astronomy, Chemistry, Electricity, Engineering, Mathematics, Mining, Navigation, Physics, Etc.* Pp. 32.

SPENCER LENS COMPANY, Buffalo, N. Y. *The Effective Use and Proper Care of the Microtome.* Pp. 88. Illustrated.

Readers are requested to mention Science when they write for catalogues.

SCIENCE

VOL. 96 FRIDAY, NOVEMBER 27, 1942 No. 2500

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PRELIMINARY ANNOUNCEMENT OF THE NEW YORK MEETING

Edited by Dr. F. R. MOULTON

PERMANENT SECRETARY

THE one hundred eleventh meeting of the association will be held in New York City from next December 28 to January 2, inclusive. This will be the sixth meeting of the association in New York, the first having been held in August, 1887, thirty-nine years after the association was organized; the second in June, 1900; the third in December, 1906–January, 1907; the fourth in December, 1916; and the fifth in December, 1928–January, 1929.

All earlier meetings of the association in New York City were held while the United States was at peace, though in December, 1916, the first World War was in its third year, and it was becoming evident that the United States would be drawn into it. Now this country is involved in a war that is making unparalleled demands upon all its resources. Under these conditions obviously no scientific meeting or other convention should be held unless it contributes much to the current war effort and begins to look forward to the post-war future. Fortunately a large meeting can be held in New York City with a minimum of railroad travel because about 3,000 members of the association live in the City and about 10,000 within three or four hours' travel.

In order to compare the coming meeting of the association with earlier meetings held in New York City, a few statistics will be presented. The membership for 1942 is as of September 30, the end of the

fiscal year. The number of papers that will be presented is of course as yet subject to some uncertainty and the number of persons who will register is only a conjecture.

Year	Membership	Papers Read	Registration
1887	1,956	250	729
1900	1,925	253	447
1906–07	4,498	360	934
1916	No record	1,252	2,100 ±
1928–29	16,328	2,200 ±	3,935
1942–43	23,671	1,500 ±	3,000 ±

The New York meeting will be not only a large gathering of scientists but one in which many fields of science will be represented. Its value will depend fully as much upon the diversity of the interests represented as upon the number of scientists attending its programs. Fifteen of the association's sections will either present individual programs or participate in joint programs. In addition, 44 affiliated associated and cooperating societies will hold sessions ranging in character from those at which scores of technical papers will be presented to dinners or luncheons at which addresses by distinguished scientists will be delivered.

Naturally the war and questions related to the war will receive a great deal of attention, often in joint programs of two or more sections or societies. For example, there will be symposia on such important subjects as food in war and peace, strategic materials, nutrition, development of humid tropics, war and post-war readjustment of personnel, the outlook for rubber, tropical medicine, science in the war of production and high-school science and the manpower problem. Although thousands of scientists are either in the armed services of the country or otherwise engaged in war work, still many scientists of the highest distinction and representatives of the Government will attend the meeting either because of their official positions or because they will appear on important programs. For example, Dr. Irving Langmuir, retiring president of the association, will deliver his retiring address, and Dr. Arthur H. Compton, now president of the association, will preside at all general sessions, while Dr. Ruiz Castañeda, a distinguished scientist from Mexico City, will deliver the Theobald Smith Lecture of the New York Society of Tropical Medicine at a joint session with the Section on Medical Sciences. The New York meeting promises to be a very good one because of the war as well as in spite of the war.

REGISTRATION

There will be two principal places of registration, one in the Hotel Commodore and the other in the Hotel Pennsylvania. In addition, there will be registration branches in the Henry Hudson Hotel and the Hotel Edison.

Each person registering will receive a General Program of the meeting, a book of about 250 pages which will contain (a) complete information respecting hotel headquarters for all sections and societies, (b) a schedule of all general sessions, (c) complete scientific programs of all sections and societies, (d) a schedule of all special dinners, luncheons and breakfasts, (e) an alphabetical index of all persons appearing on the programs, (f) lists of officers of the association and of societies participating in the meeting, (g) a brief description of each exhibit in the Science Exhibition and (h) a daily summary of events. Each person registering will receive also an identification card that may be required for admittance to certain functions or programs. Free copies of SCIENCE, *The Scientific Monthly* and the *A.A.A.S. Bulletin* and lists of the publications of the association will be available at each of the registration places, and tickets to dinners and luncheons will be on sale at the places of registration. The registration fee will be one dollar as heretofore.

HOTELS AND HEADQUARTERS

Mathematics (A): Section on Mathematics; American Mathematical Society; Mathematical Association of America; Institute of Mathematical Statistics—Hotel Governor Clinton.

Physics (B): Section on Physics; American Physical Society; American Association of Physics Teachers; Sigma Pi Sigma Physics Honor Society—Hotel Pennsylvania. American Meteorological Society—Hotel Governor Clinton.

Chemistry (C): Section on Chemistry—Hotel Pennsylvania.

Astronomy (D): Section on Astronomy—Hotel Pennsylvania.

Geology and Geography (E): Section on Geology and Geography; Geological Society of America; Association of American Geographers—Hotel Pennsylvania.

Zoological Sciences (F): Section on Zoological Sciences; American Society of Zoologists; American Society of Parasitologists—Hotel Commodore. American Association of Economic Entomologists; Entomological Society of America—Hotel New Yorker.

Botanical Sciences (G): Section on Botanical Sciences; Botanical Society of America; American Society of Plant Physiologists; American Society of Plant Taxonomists; American Fern Society—Hotel Commodore. American Phytopathological Society—Hotel Edison.

Zoological and Botanical Sciences (F–G): American Society of Naturalists; Ecological Society of America; Genetics Society of America; American Microscopical Society; Union of American Biological Societies—Hotel Commodore. National Association of Biology Teachers—Hotel Governor Clinton.

Anthropology (H): Section on Anthropology—Hotel Pennsylvania.

Psychology (I): Section on Psychology—Hotel Pennsylvania.

Social and Economic Sciences (K): Section on Social and Economic Sciences; Econometric Society—Hotel Pennsylvania. Biometrics Section, American Statistical Association; Metric Association—Hotel Commodore.

Historical and Philological Sciences (L): Section on Historical and Philological Sciences—Hotel Pennsylvania.

Engineering (M): Section on Engineering—Hotel Commodore.

Medical Sciences (N): Section on Medical Sciences; Subsection on Dentistry—Hotel Commodore. Subsection on Pharmacy; U. S. Public Health Service—Hotel Pennsylvania.

Agriculture (O): Section on Agriculture; American Society for Horticultural Science—Henry Hudson Hotel. Potato Association of America—Hotel Edison.

Education (Q): Section on Education—Hotel Pennsylvania.

Science in General: Society of the Sigma Xi; American Science Teachers Association; American Nature Study Society; Gamma Alpha Graduate Scientific Fraternity; Cooperative Committee on Science Teaching; United Chapters of Phi Beta Kappa—Hotel Pennsylvania. Sigma Delta Epsilon, Graduate Women's Fraternity; American Association of Scientific Workers—Hotel Commodore. New York State Science Teachers Association—Hotel Governor Clinton. Research Council on Problems of Alcohol—Hotel Roosevelt.

HOTEL RATES

In the list that follows the rates are for single and double rooms with bath, respectively.

Commodore, Lexington Ave and 42nd St.: $3.50, $5.50–$6.60.

Roosevelt, Madison Ave. and 45th St.: $3.50, $5.50–$6.60.

Pennsylvania, 7th Ave. and 33rd St.: $3.50–$7.70; $5.50–$9.90.

New Yorker, 34th St. and 8th Ave.: $3.50–$4.40; $5.50–$7.70.

Governor Clinton, 31st St. and 7th Ave.: $3.00–$3.85; $4.50–$7.70.

Henry Hudson, 353 W. 57th St.: $2.50–$3.00; $3.50–$4.00.

Edison, 46th St., west of Broadway: $3.00–$4.00; $4.50–$5.50.

BUSINESS SESSIONS

The Executive Committee of the Council will meet in the permanent secretary's room in the Hotel Pennsylvania on Sunday afternoon, December 27, at 4 o'clock, and thereafter as may be arranged.

The Council of the association will meet on Monday afternoon, December 28, at 2:15 in Parlor 1 in the Hotel Pennsylvania. Later sessions of the council will be held in the same room on mornings at 9 o'clock as agreed upon at the first session. It is expected that the session of the council at which the president for 1943 will be elected will be held at 9 A.M. on Thursday, December 31.

Subjects to be considered by the council are usually first brought before the executive committee through the permanent secretary. Communications for the executive committee may be submitted in writing, at the mail clerk's desk in Hotel Pennsylvania, addressed to Dr. F. R. Moulton. Matters should be communicated early in the meeting in order that their consideration may not have to be deferred to a later meeting.

The Academy Conference will be held on Monday, December 28, at 3:30 P.M., or immediately following the first session of the council, in Parlor 1 in the Hotel Pennsylvania. The session will be followed by a dinner at 6:30 P.M., in Parlor 2, Hotel Pennsylvania.

The Secretaries Conference will be held on Thursday, December 31, beginning with a dinner at 6:30 P.M., in Parlor A, Hotel Pennsylvania.

ANNUAL SCIENCE EXHIBITION

The annual science exhibition will be held in the Grand Ballroom of the Hotel Commodore. It will be open to the public from 10 A.M. until 9 P.M. on Monday-Wednesday, December 28–30, and from 9 A.M. until 1 P.M. on Thursday, December 31.

GENERAL SESSIONS

On Monday, December 28, at 8:30 P.M., Dr. Irving Langmuir, associate director of the Research Laboratory of the General Electric Company, will deliver his address as retiring president of the American Association for the Advancement of Science in the Grand Ballroom of the Hotel Pennsylvania.

On Tuesday, December 28, at 8:30 P.M., Dr. John T. Tate, dean of the College of Science, Literature and the Arts, University of Minnesota, will deliver the twenty-first annual lecture under the joint auspices of the American Association for the Advancement of Science and the Society of the Sigma Xi, in the Grand Ballroom of the Hotel Pennsylvania. The subject of Dr. Tate's lecture is "Scientists in War and Peace."

On Wednesday, December 29, at 8:30 P.M., the Honorable Dr. Hu Shih, formerly Ambassador from the Chinese Government to the Government of the United States, will deliver the eighth annual lecture under the joint auspices of the American Association for the Advancement of Science and the United Chapters of Phi Beta Kappa, in the Grand Ballroom of the Hotel Pennsylvania.

DINNERS AND LUNCHEONS

Monday

Reception following retiring president's address. Hotel Pennsylvania.

National Association of Biology Teachers. Luncheon. Hotel Governor Clinton.

Tuesday

Sigma Pi Sigma Physics Honor Society. Luncheon.
American Society of Parasitologists. Luncheon. Hunter College.
American Physical Society. Dinner.
Section on Chemistry. Dinner. Hotel Pennsylvania.
American Phytopathological Society. Dinner. Hotel Edison.
American Society of Plant Physiologists. Dinner. Hotel Commodore.
Ecologists' Dinner. Hotel Commodore.
Biologists' Smoker. Hotel Commodore.

Wednesday

American Science Teachers Association. Luncheon. Hotel Pennsylvania.
Section on Engineering. Luncheon. Hotel Commodore.
Section on Geology and Geography. Dinner.
Zoologists' Dinner. Hotel Commodore.
Entomologists' Dinner. Hotel New Yorker.
Botanists' Dinner. Hotel Commodore.
Metric Association. Dinner. Hotel Commodore.
American Society for Horticultural Science. Dinner.

Thursday

Naturalists' Dinner. Hotel Commodore.

SECTION AND SOCIETY PROGRAMS

In addition to the 15 sections of the association, about 44 affiliated and associated societies and other cooperating organizations will participate in the New York meeting. Many of the programs are subject to possible changes and the details of several programs are not yet available.

The Section on Mathematics and affiliated societies (*Dec. 28–30*). Section A will hold a joint session with the American Mathematical Society, the Mathematical Association of America and the Institute of Mathematical Statistics on Wednesday morning, at which G. T. Whyburn, vice-president of the association for the section, will deliver his retiring address on "Reduction of Mappings."

The American Mathematical Society will hold sessions from Monday to Wednesday, inclusive. On Monday the sessions will be for the presentation of general papers; on Tuesday morning Deane Montgomery will deliver an address on "Transformation Groups and Spheres"; on Tuesday afternoon the annual J. Willard Gibbs Lecture will be delivered by John von Neumann on "The Ergodic Theorem and Statistical Mechanics"; on Wednesday morning the society will join with Section A for the address of G. T. Whyburn on "Reduction of Mappings," and on Wednesday afternoon the society will hold a joint session with sections B, D and L for the presentation of a symposium on "Freedom of Thought and Science."

The Mathematical Association of America will hold a session on Wednesday morning for the discussion of the adjustments that departments of mathematics are making to meet the demands arising from the war. On Wednesday afternoon the society will join with sections A, B, D and L in the symposium on "Freedom of Thought and Science," and with the Cooperative Committee on Science Teaching in its programs on "High School Science and the War."

The Institute of Mathematical Statistics will join with the American Mathematical Society in its various programs.

The Section on Physics and affiliated societies (*Dec. 28–30*). On Tuesday the section will hold a joint session with the American Physical Society and the Society for X-ray and Electron Diffraction. On Wednesday the section will join with the American Physical Society, the American Association of Physics Teachers and sections A, D and L in two symposia, in the morning on "Freedom of Thought and Science" and in the afternoon on "The Philosophy of Physical Science."

The American Physical Society will hold sessions on Monday and Tuesday, in addition to participating in the symposia on Wednesday. On Tuesday evening the society and the American Association of Physics Teachers will hold a joint dinner.

The American Association of Physics Teachers will join with Section Q in sponsoring addresses by past presidents of the association, and will hold a session for the delivery of the annual Richtmyer Lecture and the presentation of the Oersted Medal.

The Sigma Pi Sigma Physics Honor Society will hold a luncheon on Tuesday.

The Section on Chemistry (*Dec. 29–30*) will hold three symposia, two on Tuesday and the third on Wednesday morning, and a dinner on Tuesday evening in honor of Henry C. Sherman, of Columbia University, following which a program of three papers on nutrition will be presented. All programs except that of the third symposium will be presented under the chairmanship of Hugh S. Taylor, vice-president of the association for the section.

The Tuesday morning symposium will be on "The Food Industry in War and Peace." Introductory remarks by the chairman will be followed by papers: "Sugars in Wartime," Arthur P. Hellwig; "Newer Knowledge of the Chemistry of Bread," John C. Baker; "Can Maker's Wartime Problems," James A. Stewart; "Dehydrated Foods," R. S. Hollingshead; and "Quick Frozen Foods," E. T. Gibson. The afternoon symposium on "Strategic Materials" consists of three papers: "Synthetic Rubber," Per K. Frolich; "Quinine and Antimalarials," Marston T. Bogert; and

"Non-Ferrous Materials," Colin G. Fink. The program following the Tuesday evening dinner is: "Origin and Function of Vitamin C," C. G. King; "Food Nutrition in Relation to World Adjustment," Frank G. Boudreau; and "Calcium, Riboflavin and Vitamin A in Nutrition," Henry C. Sherman.

The Wednesday morning symposium on "Utilization of Farm Commodities in Industry," under the chairmanship of O. E. May, is as follows: "Introductory Remarks. Life and Work of Henry G. Knight," O. E. May; "Fermentation as a Tool in the Industrial Utilization of Farm Products," Robert D. Coghill; "Starch Adhesives," Lee T. Smith; "Laws of Nature," Wheeler McMillen; "Starch Industry," W. B. Newkirk; and "Alcohol Present and Future," Paul Kolachov.

The Section on Geology and Geography, the Geological Society of America and the *Association of American Geographers* (*Dec. 30–31*) will hold two joint sessions on Wednesday, a joint dinner on Wednesday evening, to be followed by an address by Morris M. Leighton, vice-president of the association for the section on "Present Knowledge and Problems Concerning the Glacial History of Illinois," a session on Thursday morning for general geographic papers, and a final session in the afternoon for general geologic papers.

The Wednesday morning program is a symposium on "Development of the Humid Tropics with Special Reference to Latin America," and the afternoon symposium is on "War and Post-War Readjustment of Personnel."

The Section on Zoological Sciences and affiliated and associated societies (*Dec. 28–31*). The section will join with the American Society of Zoologists in its programs (reported to be unexpectedly large, including two symposia, one to be held on Wednesday afternoon jointly with the Genetics Society of America on "Immunological Techniques in Biological Research" and the other to be held on Thursday afternoon jointly with the American Society of Naturalists on "The Naturalist in America").

The American Association of Economic Entomologists (*Dec. 29–31*) will present a program largely devoted to problems related to the war. After a meeting of the Section of Agriculture on Tuesday morning, H. B. Weiss, president of the society, will deliver his presidential address on "Color Perception in Insects." The Tuesday afternoon program will be a joint symposium with the Entomological Society of America on "Entomology and the War." In the evening F. M. Carpenter will deliver a public address on "The Earliest Insects" before a joint meeting of the society and the Entomological Society of America.

On Wednesday morning the Section of Extension will hold a conference on the work of entomologists in support of the U. S. Department of Agriculture's goals for the production of war supplies. At the same time the society will join the Biometrics Section of the American Statistical Association, the American Phytopathological Society and the Entomological Society of America in a conference on "Reduced Dosages of Insecticides and Fungicides," under the chairmanship of C. I. Bliss. In the afternoon the Teaching Section will hold a session, and a session will be held for the presentation of general papers. On Wednesday evening the two entomological societies will hold the annual entomologists' dinner.

On Thursday morning the society will hold a general session, and its Section of Plant Quarantine and Pest Control will present a program of papers in its own field. In the afternoon the society will hold a business meeting, followed by a session for the presentation of general papers.

The Committee on Coordination of Entomology with the War Effort appointed by the society for each of thirty-five important agricultural products will report informally on its work during 1942.

The Entomological Society of America (*Dec. 29–31*) will hold eight sessions, three of which will be joint sessions with the American Association of Economic Entomologists, and the society will be a joint sponsor of the annual entomologists' dinner. The sessions for the presentation of general papers will be held on Tuesday morning, Wednesday morning and afternoon and Thursday morning and afternoon.

The American Society of Parasitologists (*Dec. 28–30*) has scheduled its program in six sessions at which 42 papers will be read by the authors, two presented only as demonstrations and 23 read by title. In addition, the society is a joint sponsor with the Section on Medical Sciences (N), the National Malaria Society, the American Society of Tropical Medicine and the New York Society of Tropical Medicine for two sessions on "Tropical Medicine."

On Monday afternoon the society will hold a session at which 11 technical papers will be presented. A session will be held on Tuesday morning at which 7 papers will be presented, following which Henry E. Meleney, president of the society, will deliver his presidential address on "The Role of Parasitologists in World War II." After the annual Parasitologists' Luncheon, the society will hold its annual business meeting. The afternoon program will consist of demonstrations and, by invitation, Eugene R. Kellersberger will deliver, by invitation, an illustrated address on "African Sleeping Sickness."

On Wednesday the society will hold both morning and afternoon sessions at each of which 11 papers will be presented.

The Section on Botanical Sciences and Affiliated Societies (*Dec. 29–31*). The section will hold a joint

session with the Botanical Society of America, the American Phytopathological Society, the American Society of Plant Physiologists, the American Society of Plant Taxonomists and the American Fern Society at which G. M. Smith, retiring vice-president for the section, will deliver his address on "The Marine Algae of the Monterey Peninsula." The address will be followed by a symposium of three papers on "Botany and the War."

The Botanical Society of America (*Dec. 29–31*) will hold sessions for the presentation of papers under the General, Paleobotanical, Physiological and Systematic sections of the society. A special program has been organized for Tuesday afternoon by the Cooperative Committee on Science Teaching on "High School Science and the War." A joint symposium of the Physiological Section of the society, the American Society of Plant Physiologists and the American Society for Horticultural Science on "Some Aspects of Mineral Nutrition in Plants and in Animals" will be presented on Wednesday afternoon. On Wednesday evening John T. Buchholz, president of the society, will deliver his retiring address at the annual dinner for all botanists.

The American Phytopathological Society (*Dec. 28–31*) will hold four joint sessions and four sessions independently.

The program for Monday afternoon consists of a conference, sponsored by the Committee on Coordination in Cereal and Vegetable Seed Treatment Research, on seed treatment with reports on 1942 results, under the chairmanship of M. B. Moore; and a discussion on the integration of seed treatment services with the war effort in 1943, under the leadership of G. L. McNew. On Monday evening the society will hold a discussion on the importance and advisability of an adequate plant disease survey to protect vital economic crops, under the direction of the Plant Disease Survey Sub-Committee of the War Emergency Committee, J. G. Leach, chairman.

On Tuesday morning there will be brief reports from the executive committee, subcommittees and regional committees of the society's War Emergency Committee, followed by a discussion to assist the War Emergency Committee in determining future policies. The afternoon session will be devoted to a discussion of the question, "What Should be our Major Plant Disease Control Objectives in 1943?"

On Tuesday afternoon the society will join in the symposium of Section G on "Botany and the War."

On Wednesday morning the society will hold a joint session with the Biometrics Section of the American Statistical Association and the American Association of Economic Entomologists on "Reduced Dosages of Insecticides and Fungicides." On Wednesday afternoon the society will hold a joint session with the Potato Association of America on potato diseases and their control.

On Thursday morning the society will hold a joint session with the American Association of Economic Entomologists for a program on "Pest Control—A New Science and its Supporting Sciences."

The American Society of Plant Physiologists (*Dec. 29–31*) will hold joint sessions with the Physiological Section of the Botanical Society of America on all three days of its meeting, and will join other societies in the field of botany in the program on Tuesday afternoon at which the address of G. M. Smith, the retiring vice-president for Section G, will be delivered. On Wednesday it will hold a joint session with the Physiological Section of the Botanical Society of America and the American Society for Horticultural Science in a symposium on "Some Aspects of Mineral Nutrition in Plants and in Animals." The annual Physiologists' dinner will be held on Tuesday evening.

The American Society of Naturalists (*Dec. 30–31*) will sponsor the Biologists' Smoker on Tuesday evening. In a joint session with the zoological and botanical societies, the society will hold a symposium on "The Naturalist in America" on Thursday afternoon. The Naturalists' dinner will be held on Thursday evening.

The Ecological Society of America (*Dec. 29–31*) will hold four joint sessions with other societies, seven sessions for the presentation of technical papers, two sessions for the transaction of business and a dinner. On Tuesday morning the society will hold two sessions, one on animal ecology and one on plant ecology. On Wednesday and Thursday mornings the society also will hold two sessions on the same subjects, and a session on Wednesday afternoon for discussion of ecological work in relation to war conditions. On Thursday afternoon the society will hold a joint symposium with the Biometrics Section of the American Statistical Association on "The Problem of Optimal Catch," under the chairmanship of A. G. Huntsman, of the Fisheries Research Board of Canada.

The Genetics Society of America (*Dec. 29–31*) will present one "Invitation Program," join in three symposia with other societies, hold two sessions for the presentation of general papers and an evening session for an informal discussion of the contributions that genetics and geneticists may make in the present emergency. The contributors to the invitation program include Martha Lee Bozeman, H. J. Muller, Elizabeth S. Russell and W. Lawson Russell, Harold H. Smith, T. M. Sonneborn, L. J. Stadler and Herschel Roman, Curt Stern, and F. S. Straus and J. W. Gowen. On Wednesday afternoon the society will join with the American Society of Zoologists in

a symposium on "Immunological Techniques in Biological Research," with the Biometrics Section of the American Statistical Association in a symposium on the "Distribution of Gene Frequencies," and with the American Society of Naturalists in a symposium on "The Naturalist in America."

The American Microscopical Society (*Dec. 28*) will hold two business sessions on Monday, the executive committee luncheon and the annual business meeting in the afternoon.

The National Association of Biology Teachers (*Dec. 28*) will hold a luncheon on Monday and a session for the presentation of papers on which Oscar Riddle, Jay B. Nash, E. Laurence Palmer and O. E. Fink will appear. In addition, there will be motion picture demonstrations by New York City high schools.

The Section on Anthropology, in cooperation with the American Association of Physical Anthropologists and with geneticists representing the Eugenics Conference, will hold sessions at which attention will be centered on two principal themes, the integration of anthropology with other biological and social sciences, and the possible contributions of anthropology to the present war and the future peace. At least twenty papers will be on the program, most of which are by authors from the New York area.

The Section on Psychology (*Dec. 29–30*) will join the Section on Education in a session at which past presidents of the association will deliver addresses on "What Should the Ordinary Citizen Know About My Field?" and the two sections will hold a joint dinner on Wednesday evening.

The Section on Social and Economic Sciences (*Dec. 30–31*) will hold two sessions of three papers each on "The Placement of Scientific Personnel in the War Effort." At the first session L. K. Frank, vice-president of the association for the section, will deliver his retiring address on "National Resources of Scientific Personnel." It is expected that the British practice in the placement of scientific personnel will be discussed by a speaker not yet announced. Leonard Carmichael will explain the scope and use of the National Roster of Scientific and Specialized Personnel, and James O. Babcock will discuss the work of the Civil Service Commission. Lieutenant Colonel Edward A. Fitzpatrick will discuss the deferment practice with respect to scientific personnel under selective service.

The Econometric Society (*Dec. 29–30*) will hold four sessions on the respective general subjects "Economic Theory and Econometrics," "Economic Statistics," "Applied Economics" and "Economic Life and Depreciation."

The Section on Historical and Philological Sciences (*Dec. 30–31*) has organized with the cooperation of the sections on mathematics, physics and astronomy two symposia on subjects of great importance in the history of science. The title of the first, which will be held on Wednesday morning, is "Freedom of Thought and Science," a symposium in commemoration of the three hundredth anniversary of Galileo's death. The participants in this symposium will be Henry Crew, on "Galileo, Pioneer in Physics"; George di Santillana, on "Galileo, the Ancient"; and Chauncey D. Leake, on "Contributions of Science to the Concept of Freedom."

The title of the second symposium, which in a sense is a companion to the first, is "Natural Philosophy," a program in commemoration of the three hundredth anniversary of Newton's birth. It will be presented on Wednesday afternoon. The participants in it are Louis T. More, on "Newton's Dualistic Philosophy of Nature"; George D. Birkhoff, on "Newtonian and Other Forms of Gravitational Theory"; and Richard C. Tolman, on "Physical Science and Philosophy." Dr. Tolman's contribution is his retiring address as vice-president of the association for the Section on Physics.

In addition, the section and the History of Science Society will hold a joint session on Thursday morning for the presentation of the program: "Ethico-genesis," retiring address of Chauncey D. Leake, vice-president for the section in 1940; "Influence of Medicine on the Development of Physical Science," by Morris R. Cohen; and "Post-War Reconstruction," by Joseph Mayer, vice-president for the section.

The Section on Engineering (*Dec. 30*) will hold a luncheon and two sessions for the presentation of papers. The general subject of the Wednesday morning session is "Aviation Medicine." The papers to be presented at this session are: "The Tilting Ballistocardiograph: Apparatus for Recording the Thrust of the Heart," by Robert W. Wilkins, M.D., the Robert Dawson Evans Memorial, Boston; "Development of Instruments for Test and Classification of Flight Personnel," by E. Lodwig and J. Zaleski, Mobile Refrigeration, Inc., New York; and "The Application of Engineering Principles to Clinical and Aviation Medicine," by Alvan L. Barach, M.D., Columbia University.

The general subject of the Wednesday afternoon session is "Dehydration of Foodstuffs." The papers to be presented at this session are: "Theory of Processes," by H. J. Masson, New York University; "Application of Theory to Manufacture," by Graham L. Montgomery, associate editor, *Food Industries,* New York; and "Military and Civilian Practice," by Captain Robert P. Melson, U. S. Quartermaster Corps, Chicago.

At luncheon on Wednesday, Willis R. Woolrich, vice-president of the association for the section and dean of engineering, the University of Texas, will deliver his retiring address on "The Romance and Engineering of Food Preservation."

Section on Medical Sciences (*Dec. 28–30*). The Monday morning session will be devoted to the presentation of a series of papers on various subjects, the contributors being Alexander Hollaender and Jesse P. Greenstein, National Institute of Health; Robert J. Fitzgerald and W. Harry Feinstone, American Cyanamid Company; W. Harry Feinstone, Richard H. Follis, Jr., Roger D. Williams and John F. Kennedy, American Cyanamid Company; W. F. Wells and M. W. Wells, University of Pennsylvania; Milton Levine and David State, Cook County Hospital, Chicago; Trigant Burrow and Hans Syz, the Lifwynn Foundation, New York; and Albert Claude, The Rockefeller Institute for Medical Research, New York.

The program for the Monday afternoon session is a symposium on "Carbohydrate Metabolism," which will be presented under the joint sponsorship of the section and the New York Section of the Society for Experimental Biology and Medicine. The program consists of six papers by D. E. Green (chairman), College of Physicians and Surgeons, Columbia University; S. Ochoa, New York University College of Medicine; W. C. Stadie, the School of Medicine, the University of Pennsylvania; W. W. Westerfield, Harvard University Medical School; K. A. C. Elliott, the Institute of the Pennsylvania Hospital, Philadelphia; R. F. Furchgott and E. Shorr, Cornell University Medical College, New York; and E. A. Evans, Jr., Birgit Vennesland and Louis Slotin, The University of Chicago.

The Section on Medicine, the *American Society of Parasitologists,* the *National Malaria Society,* the *American Society of Tropical Medicine* and the *New York Society of Tropical Medicine* are joint sponsors of two sessions on "Tropical Medicine." At the first (on Tuesday morning) session papers will be presented by Colonel J. S. Simmons, Office of the Surgeon General, the War Department; Colonel Richard P. Strong, Army Medical School, Washington; Lieutenant Colonel Thomas T. Mackie, Army Medical School, Washington; and Alan Gregg, M.D., the Rockefeller Foundation, New York. At the close of this program Arthur H. Compton, president of the association, will present the fifth Theobald Smith Award.

At the Tuesday afternoon session on "Tropical Medicine" papers will be presented by Colonel George R. Callander, Army Medical Center, Washington; Malcolm H. Soule, University of Michigan, Ann Arbor; Lowell T. Coggeshall, Institute of Public Health, University of Michigan, Ann Arbor; and Wilbur A. Sawyer, Rockefeller Foundation, International Health Division, New York. After the completion of this program, Dr. Wade W. Oliver, vice-president of the association for the Section on Medical Sciences, the Long Island College of Medicine, will deliver his retiring address on "The Man Who Lived for Tomorrow."

On Tuesday evening the section will join with the New York Society of Tropical Medicine at its Theobald Smith Lecture, which will be delivered by M. Ruiz Castañeda, M.D., Hospital General, Departamento de Investigaciones Médicas, Mexico, D. F.

The final session of the Section on Medical Sciences will be held on Wednesday morning for the presentation of papers on a variety of subjects. Those contributing papers include C. C. Macklin, University of Western Qntario, London, Ontario; W. S. Hartroft, University of Western Ontario; Miles Atkinson, New York Hospital; Jesse P. Greenstein, National Cancer Institute, Bethesda, Md.; Ben Karpman, St. Elizabeth's Hospital, Washington; Harry Eagle, The Johns Hopkins Hospital, Baltimore; and E. C. Rosenow, The Mayo Foundation, Rochester, Minn.

U. S. Public Health Service (*Dec. 28–30*) sponsors a symposium on "Drug Intoxication and Drug Addiction," which will be presented at six sessions to be held on Monday, Tuesday and Wednesday.

The Monday morning session will consist of five papers on various subjects under the general head "Barbiturates, Bromides and Chloral." The contributors include Theodore Koppanyi, R. P. Herwick, Frank Curran, Max Levin and Lawrence D. Thompson. The Monday afternoon program is on the general subject, "Cocaine, Marihuana and Peyote," to which contributions will be made by A. T. DuMez, George B. Wallace, Dudley D. Shoenfeld, Karl M. Bowman and Samuel Allentuck, and John Collier.

The remaining four sessions will all be devoted to "The Opiates." The contributors to the Tuesday morning session will be: Bertil Renborg, Lyndon F. Small, George W. Merck, Nathan B. Eddy, Fred W. Oberst and Erwin G. Gross, and Howard L. Andrews. This program relates primarily to the opium problem and opium drugs. The contributors to the afternoon program, which relates to drug addiction and physiological effects, are S. D. S. Spragg, Maurice H. Seevers, E. G. Williams, R. R. Brown, H. L. Andrews, Robert C. Batterman and C. K. Himmelsbach, F. W. Oberst and Wendell A. Preston.

On Wednesday the papers in the morning program concern primarily the drug addict. Contributors to this session will be R. R. Brown, D. C. Cameron, M. A. Diamond, Robert P. Knight, Robert H. Felix, Michael J. Pescor and J. D. Reichard. The final session on Wednesday afternoon will be concerned with the legal and administrative aspects of the prevention and control of drug addiction. The first four contributors to this session will be H. L. Anslinger, Herbert O. Calvery, Morris Ploscowe and Walter K. Urich.

The symposium will close with a public meeting at 4 o'clock on Wednesday afternoon at which Dr.

Thomas Parran, Surgeon General, U. S. Public Health Service, will introduce Dr. Lawrence Kolb, Assistant Surgeon General, Division of Mental Hygiene, U. S. Public Health Service, who will deliver an address on "Drug Addiction as a Public Health Problem."

The Section on Agriculture (*Dec. 30*) and the American Society for Horticultural Science will present a joint symposium of five papers on "Nutrition" as follows: "Nutritional Requirements of Animals. Some Deficiencies Coming through Soils and Crops," L. A. Maynard, Cornell University; "Nutritional Requirements of Man. Vitamins—the More Recent Developments," C. A. Elvehjem, the University of Wisconisn; "Field Crop Production for Efficient Feeding (retiring vice-president's address), Richard Bradfield, Cornell University; "Fruit and Vegetable Production for Efficient Food," J. R. Magness, U. S. Bureau of Plant Industry, Beltsville, Md.; and "Utilization of Foods in the Human Diet," Lydia Roberts, The University of Chicago.

The American Society for Horticultural Science (*Dec. 29–30*) will hold sectional sessions for the presentation of papers on Tuesday morning and afternoon, and in the afternoon the Section on Vegetable Crops will hold a joint session with the Potato Association of America. On Tuesday evening the society will hold round table discussions on "varieties, nomenclature, fertilizers and extension methods" and a joint session with the Biometrics Section of the American Statistical Association.

On Wednesday morning the society will hold a joint session with the Section on Agriculture for the presentation of a symposium on "Nutrition"; and in the afternoon a joint symposium with the Physiological Section of the Botanical Society of America and the American Society of Plant Physiologists on "Some Aspects of Mineral Nutrition in Plants and in Animals." On Wednesday evening it will hold its annual banquet and social evening, at which Dr. J. C. Miller, president of the society, will deliver his retiring address.

The Section on Education (*Dec. 29–30*) will meet jointly on Tuesday and Wednesday with the Section on Psychology for a series of addresses by past presidents of the association on "What Should the Ordinary Citizen Know About My Field?" Societies which will join in at least a part of this program include the American Association of Physics Teachers, the American Science Teachers Association and the Cooperative Committee on Science Teaching.

On Wednesday evening the section and the Section on Psychology will hold their annual joint dinner at which Dr. Harold Clark, vice-president for the Section on Education, will deliver his retiring address on "Scientific Experiments in Social Sciences." The recent untimely death of Dr. Edmund S. Conklin, vice-president of the association for the Section on Psychology, will deprive the dinner of a second vice-presidential address.

The Society of the Sigma Xi (*Dec. 28–29*) will hold meetings of its executive committee on Monday evening and Tuesday morning, and its forty-third annual convention on Tuesday at 3:00 P.M. On Tuesday evening the twenty-first annual Sigma Xi lecture under the joint auspices of the association and the society will be delivered by Dean John T. Tate, the University of Minnesota, on "Scientists in War and Peace."

The United Chapters of Phi Beta Kappa (*Dec. 30*). On Wednesday evening the eighth annual lecture under the joint auspices of the association and the society will be delivered by the Honorable Dr. Hu Shih, formerly Ambassador from the Chinese Government to the United States, on a subject to be announced.

The American Science Teachers Association (*Dec. 30*) will hold a session on Wednesday morning for the presentation of a program on "Science Teaching in War Time," which will be featured by an address by M. M. Peake, chief, Pre-Induction Training Section of the War Department, on "Science Teaching in Wartime as Related to Pre-Induction Training," and by an address by Brigadier General Lewis B. Hershey, director, Selective Service System, on "Science Instruction at all Levels in Relation to the War." Other papers will be presented by Ralph E. Horton and Arthur Rose.

The society will hold a luncheon on Tuesday afternoon and an afternoon session on "Curricular Problems," in which Warren W. Knox, Roy W. Hatch, Walter Thurber, Philip G. Johnson and Benjamin Harrow will participate.

Gamma Alpha Graduate Scientific Fraternity (*Dec. 29*) will hold a meeting of its executive board on Tuesday afternoon and a "convention breakfast" on Wednesday morning.

Sigma Delta Epsilon Graduate Women's Scientific Fraternity (*Dec. 28–30*) will hold a meeting of its "national council" on Monday morning and Wednesday afternoon; its national convention, at breakfast on Wednesday; and its annual luncheon for all women in science, on Tuesday noon.

The American Association of Scientific Workers (*Dec. 29–30*) will hold four sessions for the presentation of papers. The general subject for discussion at the first session, to be held on Tuesday morning, is "Scientific Research in the War Effort," under the chairmanship of Kirtley F. Mather, president of the society. Among the papers presented at this session will be two on "Science in Military and Naval Problems" by Colonel Alden H. Waitt and Dean J. W. Barker. "Medicine in the Armed Forces and on the

Home Front" is the title of a paper that will be presented by Dr. Morris Fishbein. On Tuesday evening a session will be held on the general subject "War Science in the United Nations."

Two sessions will be held on Wednesday, the morning session on "Science in the War of Production," under the chairmanship of Ralph W. Gerard. Papers will be presented on "Effective Use of Productive Manpower," "Effective Use of the Industrial Machine," "Supplies" and "Food." The general subject of the afternoon session is "Morale and Propaganda," under which papers will be included on "Potentialities of Psychiatry," "Psychological Warfare," "Practical Morale Building," "The Role of the Press in the Social Function of Science" and "Education under Total War."

The Cooperative Committee on Science Teaching (*Dec. 29*) will present a program on "High School Science and the Manpower Problem." Among the subjects that will be discussed are "Where Do We Stand?," by Robert J. Havighurst; "What Can Biology Teachers Do to Meet Manpower Needs?," by Oscar Riddle; "What Can Mathematics Teachers Do to Meet Manpower Needs?," by Raleigh Schorling; and "What Can Physical Science Teachers Do to Meet Manpower Needs?," by Karl Lark-Horovitz.

The American Biological Society (*Dec. 29*) has scheduled its annual meeting for Tuesday at 5:15 P.M.

The New York State Science Teachers Association (*Dec. 30*) will meet on Wednesday with New York City teachers working on education problems of the Army and Navy to consider what can be done to make existing science courses more effective under present-day war conditions and what new science courses should be taught. Other sessions will be held on Monday and Tuesday.

SCIENTIFIC EVENTS

DEATHS AND MEMORIALS

DR. CHARLES SCHUCHERT, emeritus professor of paleontology and historical geology of Yale University, curator of the geological collections of the Peabody Museum, died on November 20 at the age of eighty-four years.

DR. HENRY GORDON GALE, professor of physics and dean emeritus of the Division of Physical Sciences of the University of Chicago, died on November 16 at the age of sixty-eight years.

DR. O. M. BALL, professor emeritus of biology and curator of the museum of the Agricultural and Mechanical College of Texas, died on November 11 at the age of seventy-four years. He had been with the college since 1903, retiring as head of the department of biology to become curator of the museum in 1937.

DR. TRACY GILLETTE, associate geologist of the Illinois State Geological Survey, died on November 9 at the age of thirty-seven years. Before joining the staff of the Illinois Survey he was assistant to the chief geologist of the Consolidated Oil Corporation of New York City and chief geologist of the Venezuelan Petroleum Company, a subsidiary.

DR. J. N. COLLIE, F.R.S., emeritus professor of organic chemistry at University College, London, died on November 1 at the age of eighty-three years.

DR. K. N. MOSS, professor of mining at Birmingham University and dean of the faculty of science, died on October 20 at the age of fifty-one years.

THE Physical Society, London, has founded a biennial Rutherford Memorial Lecture. The first lecture was delivered on November 6 by Professor H. R. Robinson, professor of physics in the University of London (Queen Mary College), in the lecture theater of the Science Museum. He spoke on Rutherford's life and work up to the end of the Manchester period.

WAR EMERGENCY COURSES IN THE UNIVERSITY

THE YALE SCHOOL OF MEDICINE, in order to help to meet the need for physicians of the armed forces, is now prepared to admit students who have completed two years of approved pre-medical college work in recognized institutions. The cut in preparation is effective with the class which will enter on December 31, 1943. This action has been taken on the recommendation of the Association of American Medical Colleges that member colleges revise their admission requirements for the duration of the war. A detailed schedule outlining the prescribed course for admission under the new requirements will be issued soon. Applications for admission to the School of Medicine may be made at any time, but acceptance under the wartime provision will be deferred until after April 5. Upon presentation of certification from the dean, accepted students may then make application for provisional commissions in the Medical Administrative Corps, U. S. Army, or the Naval Reserve Corps. Since 1922 three years of college work have constituted the minimum requirement for admission to the school, the majority of students having held bachelor's degrees.

SEVENTEEN U. S. Army medical officers are being given a special course in laboratory training and methods in the Medical School of the University of Michigan. The officers now in training are the first

of three groups which the Army is sending to the university for 12-week instruction periods. The first group will complete the course on December 19, and a second class, which will consist of twenty-seven army physicians, will arrive at the university on January 4. No date has been set for the arrival of the third group. Dr. Howard B. Lewis, chairman of the department of biological chemistry and director of the College of Pharmacy, is the coordinator in charge of a staff of eight university professors. The extensive course provides the army physicians with the latest developments in laboratory training and methods, and is designed to develop the officers into "one-man laboratories" so that they can perform any ordinary type of laboratory procedure if they are established at some isolated Army post. The officers now in training spend forty-four hours each week in university classrooms and laboratories. All of them hold commissions as first lieutenants or higher and all are college graduates with medical degrees who have been stationed at Army hospitals and medical centers throughout the country.

SIXTY college professors and high-school teachers, some of them chairmen of departments and most of them holders of the degree of doctor of philosophy, have returned to New York University as freshmen. They are specialists in such cultural subjects as English, history, philosophy, education and foreign languages. They are taking intensive courses in physics and in mathematics to meet the impending wartime need for teachers of those studies. The course in physics will cover mechanics, heat, electricity, light and sound. During the twenty-week term, the students will assist in regular laboratory sessions in addition to attending lectures, demonstrations and laboratory classes. The course is sponsored by the U. S. Office of Education, under its war-training program in engineering, science and management and is administered by the War Training Office of the College of Engineering at University Heights, N. Y.

TEACHING and research in metallurgy will be undertaken by the University of Rochester in collaboration with industrial firms that have provided $100,000 in cash and equipment to assist in providing 5,000 trained men in metallurgy needed in the war industries.

METEOROLOGICAL OFFICERS IN THE ARMY AIR FORCES

MEN with high-school diplomas or their equivalent and college freshmen and sophomores have been made eligible for training leading to commissions as meteorological officers in the Army Air Forces.

The training course for high-school graduates or those of equivalent education will begin on February 1 and will require about twenty months. The college students will begin their course on March 1 and graduate in about fifteen months. Both groups will be paid while in training and will receive free uniforms, board, room and tuition.

A call for immediate applications for the courses has been issued by Dr. Carl G. Rossby, of the University of Chicago, chairman of the University Meteorological Committee and spokesman for the five universities giving professional meteorological training for the Armed Forces. Applications should be sent to the University Meteorological Committee, care of the University of Chicago.

High-school graduates will be given twelve months of pre-meteorological training, equivalent to two years of college mathematics and science. College freshmen and sophomores will receive six months of preliminary training, equivalent to the regular second-year course of college mathematics and science. Both groups will be paid $50 a month plus $2.35 a day for rations and quarters.

After satisfactory completion of the preliminary work, the men will become Army Aviation Cadets, with a salary of $75 a month. They then will begin eight months of advanced training, and after completing this work will be eligible for commissions as second lieutenants in the Army Air Forces.

Academic credit toward college degrees is granted for the advanced work and credit for the pre-meteorological training is now under consideration, so that the prospective meteorologist is working also for a post-war college degree. To be eligible for the training, a student must have completed a high-school course of study in trigonometry, analytic geometry and college algebra. He also must be a citizen between eighteen and thirty years of age and be able to meet the physical standards of the Army Officers Reserve Corps.

The advanced professional meteorological training is given under the auspices of the University Meteorological Committee at the University of Chicago, the University of California (Los Angeles), the California Institute of Technology, the Massachusetts Institute of Technology and New York University. The pre-meteorological training will be given at selected institutions in all parts of the country.

There are still a few openings left for properly qualified students who wish to enter directly into the professional meteorological courses that will begin on January 4. All inquiries should be addressed to the University Meteorological Committee, care of the University of Chicago.

CHARLES L. MAYER AWARDS OF THE NATIONAL SCIENCE FUND

THE establishment of two prizes of the value of $2,000, to be known as the Charles L. Mayer Awards,

which will be presented in 1942 and 1943 "for outstanding contributions to our knowledge of factors affecting the growth of animal cells with particular reference to human cancer," has been announced by Dr. William J. Robbins, chairman of the National Science Fund of the National Academy of Sciences. According to his statement, this is

a new type of prize for advancement of fundamental scientific research administered under a new type of philanthropic foundation. One prize of $2,000 will be awarded for a contribution published in 1942 or submitted in manuscript to the National Science Fund, and a similar prize in 1943. The Charles L. Mayer Awards are a new type of award in that they will be given to further the scientific work of the recipient. They are not only rewards for past accomplishments, but are also designed to increase the opportunities of those with exceptional abilities to carry on further research.

One of the major purposes of the fund is to assist donors to increase scientific dividends from their gifts. To assist the National Science Fund in effective administration of the awards, a special advisory committee has been appointed consisting of Dr. R. R. Williams, chemical director of the Bell Telephone Laboratories; Dr. Alan Gregg, director for the medical sciences of the Rockefeller Foundation; Dr. George H. Whipple, dean of the School of Medicine and Dentistry of the University of Rochester; and Dr. Elihu Root, Jr., as the lay member. Dr. Robbins stated that the committee is interested primarily in fundamental studies on the factors influencing growth of animal cells rather than applications to any particular aspect of normal or abnormal growth.

Applications based on such studies may develop in the future, but at present more knowledge is needed of the essentials concerned. However, cancer cures and cancer preventive measures can be evaluated only after years of observation and experiment, and reports of empirical success in the treatment of human cancer will not be eligible for the awards. The Mayer awards apply to the whole field of animal cell growth and the Advisory Committee of the National Science Fund offices, 515 Madison Avenue, New York City, will welcome suggestions as to outstanding published contributions and manuscripts of 1942 on any phase of this subject.

THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

BASIL O'CONNOR, president of The National Foundation for Infantile Paralysis, has announced that President Roosevelt has authorized the celebration of his birthday in January, 1943, for the annual fund-raising drive in the fight against infantile paralysis.

Mr. O'Connor states that the demands of the National Foundation, which now has chapters covering 2,900 counties of the United States, become greater each year and the amount which it spends for research constantly increases. For the fiscal year ended on September 30, the National Foundation made grants and appropriations amounting to $1,152,191, which, except for the year 1942, exceeds the amount the National Foundation has received in any one year as a result of the nationwide celebrations. The increased need for funds is due to the fact that the existence of the National Foundation has stimulated additional research in important fields that otherwise could not have been explored. He believed that it would be a great mistake to permit a lapse in the work which the President had sponsored and which had been going on intensively for ten years.

In his reply authorizing the celebration of his birthday, the President said: "I feel as you do—that any interruption in this work would be extremely inadvisable unless absolutely necessary. Until it is definitely known how to prevent a disease from occurring or how to prevent it from spreading, the threat of that disease—if it is epidemic—is one of our greatest dangers, even though the actual number of cases at any given time may be relatively small. As long as there are some cases the danger exists."

The President, concluded, "I feel strongly, therefore, that the work of the National Foundation must be continued and I am happy to have it use my birthday in its 1943 fund-raising drive."

THE NUTRITION FOUNDATION

THE sum of $1,100,000 to support a five-year program of basic research in the science of nutrition has been contributed by a group of food and closely related manufacturers, according to a statement made by George A. Sloan, president of the Nutrition Foundation, following the meeting on November 12 of the Board of Trustees held in Chicago.

Allocation of these funds for basic research in leading universities throughout the United States was discussed by the board. Additional grants-in-aid, amounting to $46,000, were appropriated; in all fifty-four grants were made this year to thirty-three colleges, universities and medical centers. The institutions receiving grants were Northwestern University, the Universities of Illinois, Notre Dame, Wisconsin, Virginia, Arkansas, Stanford, Rochester, California, Southern California and Cornell, Harvard University Medical School, Alabama Polytechnic Institute, Mt. Sinai Hospital, N. Y. Post-Graduate Hospital and Memorial Hospital. Previous grants made this year to mid-western institutions included the University of Chicago, the University of Illinois, the University of Minnesota, Purdue University, Wayne

University, the University of Wisconsin, Northwestern University and the Children's Fund of Michigan.

Illustrative of the type of studies being supported by the foundation under the direction of the director, Dr. Charles Glen King, and a distinguished Scientific Advisory Committee, are the following: Isolation of unstable food factors, protein utilization during partial starvation, utilization and distribution of radioactive iron, protection of the teeth afforded by specific nutrients, liver synthesis of blood proteins, nutritive protection against infection, the relation of vitamin A to muscle metabolism, nutritive value of low-cost vegetables, minimum vitamin needs of adults, metabolic balances in diabetes, nutritive protection of the blood vessels and the nutrients in cows' milk under specific conditions.

The program made possible by the food industry represents the greatest nation-wide contribution to basic research and education that any industry has made in the history of America, according to Dr. King. He believes that the work of the foundation "will mean much in terms of better public health and an improved food supply in the United States and Canada." He pointed out that "significant results to aid in the war effort are already arising from research grants approved this spring."

The election was announced of Safeway Stores, Inc., Oakland, Calif., and the American Sugar Refining Company, New York, N. Y., as founder members of the foundation, and the election as sustaining members of Gerber Products Company, Fremont, Mich.; Golden State Company, Ltd., San Francisco; Chr. Hansen's Laboratory, Inc., Little Falls, N. Y.; McCormick and Company, Baltimore; Minnesota Valley Canning Company, Le Sueur, and the Drackett Company, Cincinnati, Ohio. It was further announced that the Great Atlantic and Pacific Tea Company had made a substantial donation to the foundation.

SCIENTIFIC NOTES AND NEWS

THE Penrose Medal of the Geological Society of America for 1942 has been awarded to Professor C. K. Leith, of the University of Wisconsin. The medal will be presented in New York at the Christmas meeting, which was originally to have been held in Ottawa, Canada.

THE Anthony F. Lucas Gold Medal of the American Institute of Mining Engineers has been awarded to John Robert Suman, vice-president of the Humble Oil and Refining Company, Houston, Texas, a past president of the institute. The medal is in recognition of "distinguished achievement in improving the technique and practice of finding or producing petroleum."

DR. CONRAD ARNOLD ELVEHJEM, professor of agricultural chemistry at the University of Wisconsin, was presented on November 19 with the eighth annual award of distinction of the Grocery Manufacturers of America at the annual meeting of the organization, which was held in New York City.

DR. PETER KAPITZA, director of the Leningrad Physical Research Institute, was officially presented on October 27 with the Faraday Medal of the British Association of Electrical Engineers.

HONORARY membership in the Royal Agricultural Society of England, with the gold medal of the society, has been awarded to Sir George Courthope, M.P.

DR. HENRY A. PILSBRY, curator of mollusks and other invertebrates at the Academy of Natural Sciences of Philadelphia, will observe his eightieth birthday on December 8. Dr. Pilsbry has been a member of the academy for fifty-five years.

AT the recent Chicago meeting of the American Association of Land-Grant Colleges and Universities, Dr. E. E. Day, president of Cornell University, was reelected president, and Dr. C. B. Hutchison, dean of the University of California College of Agriculture, was reelected vice-president.

DR. C. JUDSON HERRICK, professor of zoology at the University of Chicago, was honored with the first membership in the recently established Denison University Research Foundation. Dr. Herrick was formerly head of the department of zoology at Denison University. The foundation has a fund immediately available for an undergraduate student or a faculty member desirous of carrying out a significant study in the field of arts or sciences. The treasurer of the fund is Dr. Millard Brelsford, Granville, Ohio, to whom applications for grants should be made.

PROFESSOR C. H. MATHEWSON, chairman of the department of metallurgy of Yale University, has been elected president of the American Institute of Mining and Metallurgical Engineers. He will take office at the annual meeting in New York in February, 1943. Erle V. Daveler, vice-president of the Utah Copper Company, and Harvey S. Mudd, consulting engineer, of Los Angeles, were elected vice-presidents.

AT the fifteenth annual meeting of the Central Society for Clinical Research held at the Drake Hotel in Chicago on November 6 and 7, officers were elected as follows: *President*, Dr. John Walker Moore, Louisville, Ky.; *Vice-president*, Dr. Cecil J. Watson, Minneapolis, and *Secretary-Treasurer*, Dr. Carl V. Moore, St. Louis.

Dr. Eugene L. Opie, since 1941 emeritus professor of pathology of Cornell University Medical College, has returned to the active direction of the department during the absence of Dr. William Dock, who has been commissioned a major in the army. Since his retirement Dr. Opie has been carrying on research work at the Rockefeller Institute for Medical Research. This work he is planning to continue.

Dr. John M. Fletcher, until his retirement four years ago professor of psychology and head of the department of the Tulane University of Louisiana, has been recalled to the university to take the place of a member of the faculty who has joined the Army.

Dr. Jean Alonzo Curran was installed on November 19 as president of the Long Island College of Medicine to fill the vacancy caused by the resignation of Dr. Frank L. Babbott.

Dr. William F. Windle, professor of microscopic anatomy at the Medical School of Northwestern University, has been appointed professor of neurology and director of the Neurologic Institute to succeed the late Dr. Stephen W. Ranson. Dr. Horace W. Magoun, associate professor of neuroanatomy, has been promoted to the professorship of microscopic anatomy to succeed Dr. Windle; Dr. Barry J. Anson to a professorship of anatomy and Dr. Paul B. Magnuson to a professorship of bone and joint surgery. He also becomes chairman of the department.

Dr. Louis L. Rusoff, of the Florida Agricultural Experiment Station, has been appointed associate dairy nutritionist at the Louisiana State University.

Dr. Normand L. Hoerr, professor of anatomy and director of the anatomical laboratories of Western Reserve University School of Medicine, has been appointed visiting professor of neuroanatomy at the School of Medicine of the University of Southern California. He will be in residence in Los Angeles until February 1, 1943. While there he will conduct the course in human neurology and will give several special lectures in southern California.

Dr. Thomas Barbour, director of the Museum of Comparative Zoology of Harvard University, has been appointed a member of the Advisory Committee on Inter-American Cooperation in Agricultural Education of the U. S. Department of State.

Sir Lawrence Bragg and Lord Normand have been appointed members of the British Standing Commission on Museums and Galleries.

Dr. H. R. Dean, master of Trinity Hall, Cambridge, has been elected the representative of the university on the General Medical Council.

Dr. W. E. Hume has been nominated by the British College of Physicians as Harveian Orator for 1943 and Dr. J. W. Brown as Bradshaw Lecturer. Dr. A. H. Gale has been appointed Milroy Lecturer.

Dr. W. V. Mayneord, of the Royal Institution, London, gave a Friday evening discourse on November 6. He spoke on the measurement of radiation for medical purposes. On December 18, Professor J. W. Munro will discuss the place of research in the control of injurious insects.

According to the *Journal* of the American Medical Association, the annual lecture sponsored by the Tau chapter of Nu Sigma Nu at Cornell University Medical College will henceforth be known as the Walter L. Niles Memorial Lecture in honor of the late Dr. Niles, who at the time of his death on December 22, 1941, was acting dean of Cornell University Medical College. Dr. Irvine H. Page, director of the Lilly Laboratory for Clinical Research, Indianapolis City Hospital, gave this year's lecture on October 20. He spoke on "The Modern Concept of Hypertension."

Dr. George C. Vaillant, director of the University Museum, Philadelphia, gave, on October 30, an address entitled "Indian Society in Ancient Mexico" at the Cranbrook Institute of Science.

The fourth annual Barnard Hospital Lecture was delivered on November 17 by Dr. Peyton Rous, of the Rockefeller Institute, in the auditorium of the St. Louis Medical Society. His subject was "The Nearer Causes of Cancer."

The annual winter meeting of the American Astronomical Society will be held from December 28 to 30 at the Dearborn Observatory of Northwestern University.

Because of war conditions, the annual dinner of the New York Academy of Sciences and Affiliated Societies will not be held this year. The annual meeting for the election of officers, the election of fellows, the presentation of reports and the transaction of other business will be held in the American Museum of Natural History at 8:00 P.M. on December 18. The meeting will be followed by a program, of which a special notice will be sent to the members.

The Council on Dental Education of the American Dental Association is now engaged in examining, for the purpose of classification, the thirty-nine dental schools of the United States. Dr. Harlan Horner is the executive secretary of the council.

The late Sir Joseph Larmor, F.R.S., has bequeathed to the University of Cambridge £2,000 to be devoted to providing medical and surgical assistance to junior members of the university.

RESEARCH grants of more than $5,000 have been received by Stanford University in support of work in tropical diseases. These include $4,000 from the Josiah Macy, Jr., Foundation, $850 from the Carnegie Corporation of New York, $400 from the National Academy of Sciences, and $200 from the May Esther Bedford Fund, Inc., of Connecticut. Other subscribers are the Higher Studies Fund at Oxford, the British Association for the Advancement of Science, the Ella Sachs Plotz Foundation and the Viking Fund. E. P. Mumford, research associate at the university, is in charge of an investigation of the geographical distribution of insects and other disease carriers and of the parasites of man in relation to the war and its aftermath. The study is being made with special emphasis on the Pacific islands.

THE regents of the University of Texas have agreed to take over the Texas Dental College. A one hundred thirty-four-acre site for the new medical center will be provided by the M. D. Anderson Foundation of Houston with funds for a dental building. The final arrangements are subject to authorization by the State Legislature.

GROUND has been broken on the "engineering quadrangle" of the Ohio State University for a small laboratory building to comprise two new units for the radiation laboratory. When completed about March 1, it will house an electrostatic generator developing three-million-volt x-rays, used to produce artificial radioactive substances, and an electron accelerator producing 20-million-volt x-rays. Other units of the radiation laboratory already installed are the cyclotron in the Engineering Experiment Station and the electron microscope in the Communications Laboratory. They represent a cooperative research program of the departments of physics, electrical engineering, chemistry and medicine, although the equipment also is available to other university departments. Because of the special work to be done in it, the new laboratory will have double walls of concrete blocks with earth between, it will be constructed half above ground and half below, and it will have a concrete roof.

The *Times*, London, reports that a grant from the Pilgrim Trust has enabled the owners of certain important manuscripts of Charles Darwin to present some of them to the Library of the University of Cambridge, and some to the British Association for preservation at Down House. The gift includes the manuscript of Charles Darwin's "Autobiography," the manuscript of the "Diary of the *Beagle*," with the field notebooks from which it was compiled, most of the manuscript of the "Origin of Species," the manuscript of "Movements of Plants," "Climbing Plants" and other works; correspondence with Wallace, Samuel Butler, Huxley and other contemporaries; a number of personal papers and of memoranda relating to Down; and a collection of pamphlets, some with annotations. It was in 1842 that Charles Darwin went to live at Down House. The first sketch, in his handwriting, of his species theory, written in 1842, is included in the gift.

THE Canadian controller of metals, according to the *Times*, London, has announced the discovery at Preissas, in northwestern Quebec, of a deposit of molybdenum. The deposit is at least 400 feet long and 200 feet deep and of an average width of 30 feet. It is hoped that its exploitation, which will be proceeded with immediately, will solve the problem of an acute metal shortage.

THE University of Ceylon was formally inaugurated at Colombo on July 14, by Dr. Ivor Jennings, the first vice-chancellor of the university. A notice in *Current Science* reads: "Ceylon's education was hitherto linked up with the University of London and although the creation of an independent university for Ceylon was under proposal for some years its inauguration so soon would not have been possible but for the extraordinary energy and enthusiasm of Dr. Jennings. His efforts have thus resulted in giving a fillip to the much desired want in the educational system of the island. The university is residential with faculties for arts and sciences, Oriental languages and medicine for the present. It is learned that the faculty of law will be added later on."

DISCUSSION

BACTERIAL GENERIC NAMES AS COMMON NOUNS

TWO recent papers[1] have called attention to the justification for using generic names in the plural, if they are treated as common nouns and are not capitalized. Their point of view has so much logic and common sense behind it that it will be readily accepted by all except those who are distinctly opposed to using terms both as scientific names and as common names. As the present writers, however, have at times opposed a similar practice among bacteriologists, this note is written to clarify the situation and to show that we are not in opposition to the opinions of Dr. Mast and Dr. Beers.

[1] Mast, SCIENCE, 96: 252, 1942; Beers, SCIENCE, 96: 403, 1942.

Generic names have been used as common nouns by bacteriologists from the earliest days of that science, as is witnessed by the ordinary use of such words as "bacteria," "bacilli," "micrococci," "streptococci"; and no one has ever raised any serious objection to this usage. Recently, however, a tendency has appeared in bacteriological literature which is more open to question. The following sentence is an illustration of this undesirable usage: "none of the rhizobia are able to grow in this medium except *Rhizobium meliloti.*" In this sentence it is obvious that "rhizobia" is not used in the sense of "specimens" or even "individuals of the genus *Rhizobium,*" but rather to mean "species (pl.) of *Rhizobium.*" In other words, the mistake is made of allowing the singular, "rhizobium," to stand for a species, not for an individual. This is the practice to which we take exception. The four terms mentioned in the first sentence of this paragraph are rarely, if ever, so used.

It is quite possible that this practice is confined to bacteriology. Certainly none of the instances mentioned by Dr. Mast and Dr. Beers represent nouns used in the above sense. In any event it seems well to call the matter to the attention of those interested in nomenclature; and to explain our reason for opposing the occasional misuse of bacterial generic names as common nouns.

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NEW YORK AGRICULTURAL EXPERIMENT STATION,
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ANOTHER MOULD WITH ANTI-BACTERIAL ABILITY[1]

SEARCHING for new anti-bacterial substances among by-products of the growth of *Fungi Imperfecti* we have noticed that one culture of *Aspergillus* sp. of the *Candidus* group gave a positive reaction for the presence of citrinin. The substance isolated in crystalline form showed the same properties as those described by Hetherington and Raistrick.[2] Its bacteriostatic properties and selective action on Gram-positive bacteria further indicate the similarity to citrinin.

Comparing the data published by Oxford[3] on the bacteriostatic power of citrinin it appears that our substance in purified or crude state is somewhat stronger. Thus growth of *Staphylococcus aureus,* in nutrient or 1 per cent. glucose broth, was completely inhibited in dilution 1:64,000; *Staph. albus* 1:128,000; *B. mycoides* 1:128,000. Partial inhibition (about 50 per cent. opacity) was shown in 1:1,024,000 dilution for all above-mentioned organisms. In lower dilutions (1:8,000 or 125γ per ml) it showed bactericidal ability in the case of *Staph. aureus* and *albus.* Furthermore, autoclaving of the serial dilutions for 30 minutes at 15 pounds pressure did not reduce the bacteriostatic power of the substance.

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DIVISION OF BACTERIOLOGY AND
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OTTAWA

[1] Contribution No. 157 (Journal Series).
[2] A. C. Hetherington and H. Raistrick. *Phil. Trans. Royal Soc. of London,* Series B, 220: 269–295. 1931.
[3] A. E. Oxford. *Chem. Ind.,* 61: 48–51. 1942.

A METEORITE FROM VERMONT

THE first meteorite to be recorded from Vermont was discovered by the writer on Whitcomb Hill in the town of Strafford, Vermont, in August, 1942, while engaged in geological field work. It was not seen to fall but lay upon the surface of the ground when found.

The specimen is an iron meteorite weighing five pounds and two ounces. Its shape is triangular, much like that of a flatiron, having a maximum length and width of 5.5 inches and 4 inches, respectively, and a thickness of 2.5 inches. The characteristic Widmanstätten figures were brought out microscopically on a polished surface by etching with a dilute solution of nitric acid. The weathered surface is a dark, rusty brown.

The meteorite has been named the South Strafford meteorite because of the nearness of this village to the place of discovery. Further work on this meteorite is in progress.

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THE TOOLS OF SCIENCE AND THE WAR INDUSTRY

THE services that science can render to the war effort are of many kinds. The means for contributing some are readily at hand, while the means for contributing others must be created. Stanford University has had the privilege of assisting in an enterprise of the latter class that deserves to be reported as a possible source of ideas applicable in other instances. The experience is especially instructive as evidence of what can be accomplished through cooperation of a number of unrelated agencies working toward a common goal that no one of the agencies could have attained by itself.

An inquiry initiated at Stanford last spring into opportunities for contribution of statisticians to the war effort led to a suggestion from Dr. W. Edwards Deming, that a short course be offered to promote the adoption of recently developed statistical methods of quality control, and improved methods of sampling for tests of quality, in West Coast war industries. The suggestion posed two problems: that of providing for the requisite instruction, and that of bringing to

the course men actually in a position to apply the methods.

Suitable machinery for organizing and financing the suggested course was already in existence in the engineering science and management War Training Program, financed by the Office of Education. The institutional director of the program at Stanford took up the plan with enthusiasm. Aided by active support from the Ordnance Department, through its San Francisco District Office, he was able to bring together in early July, less than six weeks after the original suggestion had been received, a group of twenty-nine key men from industries holding war contracts and from procurement agencies of various branches of the armed services. These men, with three others, entered upon an intensive ten-day course with classes running eight hours a day. All thirty-two men completed the course.

The success of the first course, given at Stanford University in July, led to demand for a repetition. A second course, offered in Los Angeles in September, was equally gratifying in its results. Ten of the men attending the second course came from organizations that had sent one or two men each to the first course. Further repetitions of the course are in prospect. The two courses thus far offered have given training in specialized statistical methods for saving time and materials in the war production program to thirty-nine key men from war industries, assigned by their companies to attend the course, to fifteen men assigned by various branches of the armed services, and to five others admitted on the ground that because of previous special training in statistics they might become peculiarly useful to either war industry or the armed services.

The instructional program itself rested on a high degree of cooperation. Four instructors worked together in each course. Two, Professors Eugene L. Grant and Holbrook Working, came to the enterprise from different departments of Stanford University. The Bureau of the Census contributed the services for both courses of Dr. W. Edwards Deming. A fourth man on the staff for each course was drawn from industry to present the point of view of a man meeting from day to day the practical problems of applying the methods under discussion. This place was taken in the first course by Mr. Charles R. Mummery, of The Hoover Company, North Canton, Ohio, and in the second course, by Mr. Ralph E. Wareham, of the General Electric Company.

Holbrook Working,
Chairman of the Committee on Instruction in Statistics
Stanford University

SCIENTIFIC BOOKS

THE CRISIS OF OUR AGE

The Crisis of Our Age: The Social and Cultural Outlook. By Pitirim A. Sorokin. Pp. 338. New York: E. P. Dutton and Company., Inc. 1941. $3.50.

This is an epitome for the general reader of the author's technical four-tome "Social and Cultural Dynamics." The large proportion of space devoted to the historic rôle of the sciences in Western civilization would alone justify a review of the work in Science.

That our Western civilization is in crisis few would question. The crisis, Sorokin maintains, is not merely an economic or political one. It involves almost the whole of Western culture and society: art and science, philosophy and religion, law and morals, manners and mores, the forms of social, political and economic organization, the nature of marriage and the family. These various phases of our culture and society are largely interdependent and each is largely derivative from a dominant form of prevalently held basic principles and values.

To the three dominant forms or supersystems which Sorokin analyzes he gives the names ideational, idealistic and sensate. In the ideational form, supersensory, other-worldly and religious reality and value are regarded as supreme. In the sensate form, sensory, this-worldly and secular reality and value are so regarded, while the supersensory is considered either doubtful as reality or fictitious as value. In the idealistic form, both realities and values are recognized. At no given time in any given culture and society does any one of the three forms exclusively prevail and operate, either in all compartments of life or among all classes and individuals, to the complete blackout of the others. The three supersystems are conceived more as dominant forms of integration than as absolutely monopolistic ones.

One or other of the forms has historically held sway in different periods of all the great cultures. Thus, Greek culture from the eighth to the end of the sixth century B.C. was dominantly ideational, and in the fifth and fourth centuries B.C., idealistic; while Greco-Roman culture from the third century B.C. to about the fourth century A.D. was sensate. Then the ideational configuration came to the fore, persisted through the medieval period to the end of the twelfth century, and

was succeeded by the idealistic in the thirteenth and fourteenth centuries, which in turn gave place to the sensate that has prevailed in modern Western culture for the last four or five hundred years.

The cause of the historical oscillation from system to system is at base internal. Both the ideational and the sensate systems are partly true and partly false. When one of them tends to become monopolistic, its false part grows at the expense of its valid part, leading to a partial retreat from total human reality and value, with disastrous consequences for intellectual and esthetic creativeness, economic security and social order.

Our present crisis is due, Sorokin believes, to the fact that the fundamental form of modern Western culture and society—the sensate—is declining. This decline will be followed, not by the death of Western civilization as such, in the Spenglerian or other pessimistic sense, but by survival with the emergence of and shift to a neo-ideational or neo-idealistic dominant configuration.

The present work, like the original "Social and Cultural Dynamics," is well calculated to call forth either rabid or rapturous responses in the reader, depending in part on his sympathies with or antipathies to "ideational," "idealistic" or "sensate" philosophies of life. For while the author defends his hypothesis with an impressive mass of factual data, he permits his own sympathies and antipathies to show through on page after page of his discussion, and perhaps even in the appellation "sensate."

As regards Sorokin's statistical methods, for which he has been so severely criticized, it must be said in his defense that most of the criticisms have been met by him in anticipation (*cf.*, *e.g.*, "Social and Cultural Dynamics," III, N. Y., 1937, ch. 9). He explicitly recognizes weaknesses in his statistical treatment of the cultural and social units manipulated, but maintains that it yields an appreciably more accurate measurement of long-time cultural drifts than does the customary verbal quantitative treatment of the classic historian.

Less defensible and more questionable are a number of concrete historical statements. Such, to illustrate by just three, are: "the climax (in number and importance of discoveries) in most of the exact sciences was reached, not in the twentieth century, but either in the nineteenth or (for mathematics) the eighteenth century" (p. 128); "psychology and anthropology of the twentieth century are, again, either a mere accumulation of so-called facts or, even worse, a definite decline so far as real insight into the respective phenomena is concerned" (p. 267); "mental disease [not merely clinical recognition thereof or institutional intake] has been on the increase, particularly during the past few decades" (p. 207).

Sorokin appears to have made a good case for the operation of internal factors, above noted, in the historic oscillation of supersystems. But are these the only crucial factors? For example, as "ideational" patterns tend on the whole to be more prominent in cultures of low than in those of high scientific and technological levels, may not the decline of the sensate supersystem and the emergence of the ideational in Europe about the fourth and fifth centuries A.D. have been in critical measure the consequence of external causation, namely, the barbarian invasion? As regards, then, Sorokin's prognosis for Western civilization, one is inclined to say: Maybe, but can we predict without knowledge of *all* the great determinant factors in change?

All in all, however, whether we agree or disagree in whole or in part with the author, his great synthesis is an arresting one. He has had the courage to attempt a task of exceptional magnitude and he has carried it to completion with dogged energy, singular resourcefulness and originality, and high creative ability. His theory, at its lowest valuation, gives us a formula that enables us to think of great masses of data in an orderly and meaningful way. At a higher valuation, it gives us illuminating insights into some of the most significant inner realities of culture, society and life, and of the impact of science thereon.

John M. Cooper

The Catholic University of America

SPECIAL ARTICLES

THE PRESENCE OF A CORTIN-LIKE SUBSTANCE (COLD PROTECTING MATERIAL) IN THE URINE OF NORMAL MEN[1]

The fact that adrenalectomized rats and mice are more sensitive to low environmental temperatures than normal animals has been demonstrated by various investigators[2, 3, 4, 5]. Adrenalectomized rats subjected to low temperatures may be protected by adrenal

[1] Supported in part by a grant from the Josiah Macy Jr. Foundation.

[2] F. A. Hartman, K. A. Brownell and A. A. Crosby, *Am. Jour. Physiol.*, 98: 674, 1931.

[3] H. Selye and V. Schenker, *Proc. Soc. Exp. Biol. and Med.*, 39: 518, 1938.

[4] R. Tyslowitz and E. B. Astwood, *Am. Jour. Physiol.*, 136: 22, 1942.

[5] M. Zarrow, *Proc. Soc. Exp. Biol. and Med.*, 50: 135, 1942.

cortical extracts[2, 3, 4] and by pure adrenal cortical steroids such as desoxycorticosterone[4, 6], corticosterone[7] and compound E[7]. Adrenalectomized mice may also be protected by adrenal cortical extract[6], desoxycorticosterone[5, 6] and progesterone[5]. We have used this test of sensitivity of adrenalectomized rats to low temperatures to demonstrate material in the urine of normal men which appears to be related in its biological action to the adrenal cortical steroids. We are not prepared at this time to say whether this biologically active material is specifically an adrenal cortical steroid metabolite. Our experience thus far, however, suggests that this may be true.

Cortin-like action of extracts of urine from various types of patients has been reported by Anderson, Haymaker and Joseph[8] and by Weil and Browne[9, 10]. These investigators studied urine from patients with Cushing's syndrome, hypertension, chronic osteomyelitis, as well as post-operative patients who had no symptoms of shock. The former group of investigators used the maintenance of the adrenalectomized rats as their means of demonstrating biological activity, while the latter group used the technique described by Selye and Schenker[3] involving the sensitivity of the adrenalectomized rats to cold. Perla and Marmorstein-Gottesman[11] reported the presence of a benzene soluble material in human urine which was capable of increasing the resistance of adrenalectomized rats to histamine, while Grollman and Firor[12] reported that benzene extracts of human urine were capable of maintaining adrenalectomized rats.

The urines of three normal men, 26, 26 and 31 years of age, respectively, were collected over a three-day period. The fresh urine was extracted three times with ethylene dichloride at room temperature. For each extraction one part of ethylene dichloride to four parts of urine was used. The ethylene dichloride extracts were evaporated to dryness *in vacuo*, taken up in small volumes of absolute ethanol and again evaporated to dryness. This procedure was repeated twice. This technique is similar to that previously employed by Weil and Browne[10]. The final dry, brownish oil was taken up in 10 per cent. ethanol and administered by stomach tube to adrenalectomized rats weighing 35 to 45 grams. The rats were adrenalectomized 24 hours before the assay was run. The details of the assay technique will be described in another report.

[6] Unpublished experiments.

[7] E. C. Kendall, *Jour. Am. Med. Assn.*, 116: 2394, 1941.

[8] E. Anderson, W. Haymaker and M. Joseph, *Endocrinology*, 23: 398, 1938.

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[11] D. Perla and J. Marmorsten-Gottesman, *Proc. Soc. Exp. Biol. and Med.*, 28: 1024, 1931.

[12] A. Grollman and W. W. Firor, *Proc. Soc. Exp. Biol. and Med.*, 30: 669, 1932–3.

The results on the urines collected from three normal men are represented in Table 1. It is seen that the

TABLE 1

RESPONSE OF ADRENALECTOMIZED ANIMALS (EXPOSED TO 5° C.) TO EXTRACTS, FROM THE URINE OF NORMAL MEN

Subject Number	Subject Age	Urine collection Days	Administered per rat extract equivalent cc	Administered per rat extract equivalent Hours	Number of rats	Mean survival Hours	Increase in mean survival Per cent.
—	—	—	0	0	9	5.9	—
1.	26	3	295	6.0	8	8.7	48
2.	26	3	194	5.8	10	8.1	37
3.	31	3	236	6.0	9	8.9	51

equivalent of 6.0, 5.8 and 6.0 hours of urine respectively produced increases in survival time of 48 per cent., 37 per cent. and 51 per cent., respectively. When these increments are compared to the responses found for a Wilson Adrenal Cortical extract, it is found that the urine contains cortin-like material equivalent to 0.15 to 0.18 cc of extract per day.

In addition to the experiment described above, it has been possible to demonstrate cortin-like activity in the extracts of composite samples of normal male urine and in the urine of post-operative male patients, but we have been unable thus far to detect such activity in the urine of patients with Addison's disease.

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HAY FEVER AND VITAMIN C

DURING the past four years one of us made occasional observations indicating a lowering of the body level of vitamin C during hay-fever attacks.

HISTAMINE THEORY

Other workers developed the interesting theory that histamine, $C_5H_9N_3$, although a normal constituent of the blood, is thrown into the blood stream in excessive amounts during allergic attacks and that this excess histamine is responsible for some of the unpleasant symptoms. On the assumption that histamine might react with vitamin C, or ascorbic acid, we mixed water solutions of the two substances but observed no reaction in absence of free oxygen. Upon bubbling a slow stream of air through the solution it was easy to detect evolution of ammonia. Titration with 2,6-dichlorophenol-indophenol showed loss of vitamin C. Later we learned that this reaction was already known. Since there is a little dissolved oxygen in blood serum, the body furnishes the proper conditions for very slow reaction.

REQUIRED REPLACEMENT OF VITAMIN C

A low level of vitamin C in the body causes weakness as well as other ills, so it is apparent that losses due to hay fever should be made good by a diet extremely rich in this vitamin, or even, in severe attacks, by administration of the pure synthetic product.

Many tests of this idea have been made by others, but there has been much confusion as to the dosage of ascorbic acid required for relief.

We therefore experimented[1] with twenty-five hay-

[1] We are in debt to Dr. H. A. B. Dunning, of Baltimore, for generous support of this research.

TABLE 1

THE RESULTS GIVEN IN TABLE 1 ARE SIGNIFICANT. THE SIGN "——" MEANS THERE WAS NO DETERMINATION OR DOSAGE FOR THAT COLUMN

Patient number	Vitamin C in 24-hour urine before dosage	Excretion of C after one week of 100 mg daily	Symptoms after one week of 100 mg daily	Symptoms after week of 200 mg daily	Symptoms after dosage of 500 mg daily
1	49 mg	——	——	"Immense improvement." Gain after two days	——
2	8 mg	218 mg ? (after dose of 200 mg daily)	No relief	Distinct gain	"No hay fever" after 3 days
3	8 mg	1–6 mg (after 2 days of 600 mg rose to 96 mg)	No relief	——	"Much better" after 2 days
4	42 mg	90 mg	No relief	Slight gain	"Almost no hay fever" after 4 days
5	20 mg	35 mg	Some relief	Decided relief	"Almost no hay fever" after 2 days
6	11 mg	73 mg	No relief	No relief	"Hay fever practically gone" after 3 days
7	6 mg	1–6 mg (after 3 days of 500 mg rose to 102 mg)	Some relief	——	Great relief after 3 days
8	16 mg	(after 12 days rose to 221 mg)	——	Great relief	——
9	——	——	Little relief	Great relief	——
10	——	——	Little relief	Great relief	——
11	——	——	Little relief	"Felt fine"	——
12	——	——	——	"Better physical condition"	"Highly favorable reaction. More refreshing sleep" after 2 days
13	16 mg	160 mg ?	No relief	——	"Distinctly better" after 3 days
14	——	——	——	Great relief in few days	——
15	——	——	——	"Much less tired"	——
16	——	——	Definitely improved	——	——
17	9.5 mg	105 mg	Some relief	——	——
18	——	——	"It helped"	——	——
19	——	——	——	Began in July. "No hay fever at all—after years of suffering"	——
20	0–5 mg	67 mg (after 10 days of 200 mg daily)	——	Vast improvement. From weakness to vigor	——
21	——	——	——	——	(Invalid from asthma.) After 1 week became astonishingly vigorous and healthy
22	High	Higher	No relief	No relief	Little relief
23	63 mg	118 mg ?	No relief	——	No relief after 3 days
24	10 mg	——	Broke out in rash and quit	——	——
25	——	——	——	——	1000 mg gave great relief the next day

fever sufferers in Oberlin at three levels of vitamin intake; 100 mg, 200 mg and 500 mg daily, administered during the ragweed season from August 15 to September 15.

URINARY EXCRETION

In most instances we were able to determine the 24-hour urinary excretion[2] of vitamin C before giving the first dose. Whenever possible we determined the daily excretion again after one week. It is the general opinion that a healthy individual of average weight excretes from 30 to 50 mg of vitamin C daily in the urine.

With ordinary methods of collection we have observed considerable loss by oxidation, so we used the very simple but effective method previously devised by Holmes and Campbell.[3]

The maximum pollen count in Cleveland, thirty-five miles from Oberlin, averaged about 87 for the last half of August and about 80 for the first half of September. "Sneezing begins at 15." Oberlin, away from Lake Erie, has more pollen than Cleveland.

The initial daily vitamin C excretion of twelve patients (including three not charted) averaged only 10 mg, indicating a very low level, due to destruction or inactivation of the vitamin. One excreted 20 mg, three were satisfactory and the others were not measured.

Usually, after a week of treatment the excretion rose to excellent levels, in some instances indicating body saturation. Strangely enough, patients No. 1 and No. 4 showed very good vitamin C levels before starting treatment, yet they were greatly benefited by adequate dosage.

It is evident from the table that only five sufferers made a noticeable gain in health after a week of 100 mg daily dosage, while twelve gained decidedly after a similar period of 200 mg dosage and eight reported remarkable improvement after three or four days at the 500 mg level. One got almost immediate relief after a single dose of 1,000 mg. Apparently there was distinct gain with 88 per cent. of the patients.

TREATMENT

We strongly recommend that pharmaceutical firms prepare 250 mg tablets of vitamin C (or capsules to be emptied on the tongue) in order to lower the cost and to simplify dosage. The patient (after consulting the family physician, as was done in our own recorded experiments) would do well to begin with a daily 250 mg dose and, if no decided improvement results after one week, to try 500 mg daily until satisfactory progress is observed. After that he might get along comfortably on 250 mg or less during the season.

Since excess vitamin C is excreted rapidly in the urine, it is impossible to go beyond body saturation. Rarely are any irritating effects observed, yet one of our patients reported development of a rash.

REDUCING ACIDITY FOR SENSITIVE PATIENTS

Patients objecting to the acidity of ascorbic acid are advised to mix with the vitamin an amount of baking soda nearly equivalent chemically. If the vitamin is visibly crystalline, equal volumes of vitamin and sodium bicarbonate are used; if the vitamin is in a fluffy powder form, about one third that volume of sodium bicarbonate will serve. It is a mistake to mix water solutions to be kept for days, as oxidation occurs rapidly in the neutralized vitamin solution. We proved, by tests on several people, that after keeping a mixture of the dry powders eight hours and then administering there was no apparent loss of the vitamin. Patients with gastric ulcer, usually on a diet low in vitamin C because of difficulty with the roughage of vegetables and the acidity of fruits, may profit by the observation above.

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[2] Miss Jean Risinger assisted us with some of the analytical work.

[3] Harry N. Holmes and Kathryn Campbell, *Jour. Lab. Clin. Med.*, 24: 1293, 1939.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLIFIED PROCEDURE FOR THE CONCENTRATION AND PURIFICATION OF INFLUENZA VIRUS[1]

THE observations of Hirst[2] and McClelland and Hare[3] have clearly demonstrated that influenza virus in chorioallantoic fluid of the chick embryo can be directly adsorbed by the erythrocytes of the embryo. Hirst[4] has also shown that the adsorbed virus can be readily eluted from the red blood cells at temperatures of 22° to 37° C. In addition, these investigators have pointed out[5,6] that the precipitate which forms when

[1] These investigations were aided through the Commission on Influenza, Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army, Preventive Medicine Division, Office of the Surgeon General, United States Army.

[2] G. K. Hirst, SCIENCE, 73: 335, 1941.

[3] L. McClelland and R. Hare, *Canadian Public Health Jour.*, 32: 530, 1941.

[4] G. K. Hirst, *Jour. Exp. Med.*, 76: 195, 1942.

[5] G. K. Hirst, E. R. Rickard and L. Whitman, *Proc. Soc. Exp. Biol. and Med.*, 50: 129, 1942.

infected fluid is frozen and then thawed contains the bulk of active virus and have employed the procedure for the concentration of influenza virus.

Certain technical difficulties accompany concentration by precipitation. Care must be taken, while harvesting the fluid, not to rupture the blood vessels since adsorption of virus by red cells results in an appreciable diminution in titer of the fluid. The temperature during the collection of the precipitate must be maintained at or about 0° C. and agitation must be carefully avoided. The procedure for concentration of the Lee strain of Type B virus requires an adjustment in pH. There is a bulk of non-specific material in the precipitate, only part of which is soluble. After drying *in vacuo* the insoluble residue increases.

It appeared that utilization of embryonic red cells for the concentration of virus might eliminate some of these difficulties if satisfactory adsorption and elution could be obtained without loss of activity. This has been possible. The essential features of the procedure adopted are as follows: Into the allantoic sac of hen's eggs, containing embryos in the eleventh or twelfth days of incubation, is inoculated 0.1 cc of a 10^{-3} dilution of infected allantoic fluid in physiological salt solution. Either the PR8 strain[7] of type A or the Lee strain[8] of type B virus has been used. The extra-embryonic fluids are harvested 48 hours later. The shell over the normal air sac is removed, the shell and chorioallantoic membranes and the blood vessels are torn with sterile forceps; the amnion and its main vessel are also torn. The embryo is allowed to bleed into the fluid while the egg is rotated so as to obtain mixing and to prevent the formation of clots. The bloody fluid is removed by aspiration with needle and syringe and collected in a 250 cc centrifuge bottle immersed in an ice-water bath at a temperature of 4° to 6° C. Chilling is important, since it increases the degree of adsorption and limits the elution which occurs rapidly at higher temperatures. The fluid from additional eggs is collected in the same manner and added. The red cells agglutinate while still in the egg and form coarse clumps in the collecting vessel. Since adsorption occurs very rapidly the process reaches its maximum in the time required to harvest the fluid from a few eggs.

When the desired volume of fluid is collected, the red cells, constituting 2 to 2.5 per cent. of the total volume, are separated by centrifugation in a chilled cup for three minutes at 500 to 1,000 r.p.m. The supernatant fluid and any light fibrinous aggregates are poured off and discarded. At this stage the cells are strikingly cohesive and resemble a disc of soft gelatin. The surface of the sediment is gently rinsed with cold (4° C.) 0.85 per cent. sodium chloride solution. No effort is made at this time to break up the agglutinated cells, since it tends to induce hemolysis. The wash fluid remains clear. To the washed, sedimented cells physiological salt solution is added in an amount equal to one tenth the original volume or less, depending upon the degree of concentration desired. The mixture is placed in a water bath at 37° C., agitated gently until the temperature is raised and the suspension is then placed in an incubator at 37° C. for two and one half hours. The clumps of agglutinated cells gradually disperse as the virus is released. The red cells are then centrifuged from the suspension and the supernatant fluid which represents the concentrate is removed. The preparation is usually slightly opalescent with a faint pink tinge.

In this manner approximately tenfold concentration of both the PR8 and Lee strains of virus has been obtained consistently. The infectious and agglutinating titers of the concentrate have remained essentially constant for at least three weeks in the refrigerator. Evidence points to the fact that the major portion of the inert chick protein is eliminated in that no significant precipitate is observed when the material is thawed after freezing with CO_2 ice nor after prolonged standing in the refrigerator. On rehydration after freezing and drying a small amount of finely suspended material remains undissolved.

The results indicate that the simplified procedure of adsorption and elution from embryonic red cells is as effective as precipitation in concentrating influenza virus from infected chorioallantoic fluid and takes advantage of technical features which serve as sources of difficulty in the precipitation process. Experimental results will be presented in detail in a subsequent publication.

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SCIENCE NEWS

Science Service, Washington, D. C.

A PLANET OUTSIDE OUR SOLAR SYSTEM

THE first evidence ever produced for the existence of any planet among the billions of suns that swarm outside our own little solar system was presented at Philadelphia before the meeting of the American Philosophical Society by K. Aa. Strand, research associate at the Sproul Observatory of Swarthmore College. No one has ever seen the planet. Probably no one ever will. Like many other things of whose existence we are fairly well assured, this extra-solar-system planet manifests its presence by what it does.

Mr. Strand was making a study of a comparatively obscure double star in Cygnus, the Swan or Northern Cross. As with all objects of its class, the two stars that form the double one circle around and around each other in an eternal dance. But Mr. Strand noticed on the many photographic plates he examined that the orbits of the two stars were not exactly smooth. Something caused irregularities in the star paths—perturbations, astronomers call them.

The only thing that could explain the irregularities was the presence of a third object, close enough and massive enough to drag one or both slightly out of orbit by gravitational pull. Calculations indicated that this must be an object far smaller than any known star—only one sixtieth the mass of the sun, which is one of the smaller stars. This gives it a mass about sixteen times that of Jupiter in our own system. It swings around the star that is its sun once every 4.9 years, and has a decidedly lopsided orbit, contrasting strongly with the nearly circular paths of the planets of our own system.

NOVA PUPPIS

ASTRONOMERS at the Harvard Observatory searching their longest exposure photographs taken through their largest telescopes are unable to find any star that existed in past years where Nova Puppis flashed forth in the sky. This means that the star increased in brilliance at least 6,000,000 times, a rise of 17 magnitudes at least, because it must have been fainter than the 18th magnitude that can be detected by stellar photography.

Miss Constance D. Boyd and Dr. Fred L. Whipple made preliminary measures of plates going to the 16th magnitude, and found no star present where the nova is located.

And even on three-hour exposure plates taken with the Bruce 24-inch camera at Harvard's southern station at Bloemfontein, South Africa, which goes nearly to the 18th magnitude, they fail to find a trace of the star.

The great increase in brilliance almost puts the star in the ranks of the supernovae, which are usually observed only in the far spiral nebulae. These are galaxies like our own Milky Way, but they are very numerous. Consequently, supernovae are fairly frequent, but only about every 300 or 500 years does one appear in a galaxy. However, further studies of magnitude changes and spectrum must be made before the character of this latest nova can be ascertained.

Meanwhile, Nova Puppis is fading rapidly, nearly a magnitude every 24 hours. It reached its peak on November 12. Amateur astronomers, particularly members of the American Association of Variable Star Observers, are being urged to watch it regularly, to see if it suddenly increases its light again. Fluctuations may be expected.

Spectra of the nova are being taken at all the large observatories. Such spectra show the rapid changes which are taking place in the condition of the star following its maximum light. There is indication that a shell of gas may be expanding around the star at a speed of possibly 1,000 kilometers per second. The star's distance also seems to be very great, probably on the order of several thousand light years. This is more or less confirmed by the extreme faintness before its outburst.

COLOR VISION

OBSERVERS with weak color vision do have an advantage in detecting faulty camouflage, was pointed out by Dr. Deane B. Judd, of the National Bureau of Standards, at a recent meeting of the Washington Academy of Sciences.

Men who are completely colorblind or even partially colorblind do not have this advantage. Since, out of every 20 men, about one man has weak color vision and another is colorblind, the Army probably already has a good share of men capable of spotting the enemy's blunders in camouflage.

The most common form of colorblindness is the inability to distinguish red from green. Men with this color vision defect find it difficult to pick out ripe strawberries from green or to pick a rotten apple from a barrel of red apples. Since the vision of such persons for blue and yellow is normal, they are said to be only partially colorblind. To hide a military position from such a person it would be necessary to see that it was no lighter and no darker than the surrounding country. And it must be no bluer and no yellower.

But the partially colorblind person would not notice if the position happened to be a little redder or a little greener than objects around it, or if it were lacking in those colors.

The partially colorblind person, therefore, usually has no advantage over the man with normal color vision in detecting camouflage. If a roof or a gun-shield is painted so that the normal eye can not tell it from the ground or the foliage, the partially colorblind person can not distinguish it either.

Since nature provides the best camouflage, the Army usually prefers to use actual vegetation or dirt whenever possible to hide positions. But cut branches change color when they dry out and the leaves wilt. Dirt used in this way may dry out more rapidly after a rainstorm than the dirt on the ground. This produces slight differences in color and results in imperfect camouflage. Another fault in camouflage is in paint intended to match the surroundings. Such paint, even when it is a close match,

is likely to differ in reflectances in some portions of the spectrum. It is such imperfections, not noticeable to the normal eye, that are picked up by the man who has weak color vision.

There are a few situations in which the red-green colorblind man has an advantage in detecting camouflage. In a variegated pattern made up of patches of reddish brown earth and yellowish green foliage, areas that are a little too light or too bluish are lost to the normal eye because of the larger red-green differences in the scene. But the colorblind observer doesn't see a variegated pattern of irregular red and green splotches. To him, there is a nearly uniform yellowish-brown field. A spot that is too light or too bluish would show up conspicuously to his eyes.

The normal individual can not make use of filters to fake weak color vision in order to detect camouflage. In order to screen out red and green, a filter would also screen out most of the light and make it very difficult to see anything. And the filter would not accurately duplicate the color vision of the partially colorblind person at that.—Marjorie Van de Water.

USE OF THROMBIN TO STOP BLEEDING

Thrombin, natural clotting agent of the blood which is formed when blood is shed, is being widely used in the U.S.S.R. as a means of stopping dangerous bleeding from war wounds and is credited with saving the lives of many wounded men.

In 1941, after long research in the laboratories of Moscow University, I discovered a method of obtaining large quantities of sterilized, dissolved thrombin. When mixed with blood this solution will clot it within three to five seconds. Experiments on laboratory animals with this preparation confirmed the theoretical assumptions. Parenchymatic bleeding from injured liver, spleen or kidneys rapidly ceased after the wound was irrigated with thrombin solution. The preparation was then tested in surgical clinics and hospitals with good results, after which it began to be manufactured in large quantities for use in hospitals and dressing stations at the front.

Several soldiers with head wounds were brought to the neurosurgical clinic. In the case of two of them, shell splinters had penetrated deep into the brain and their removal was fraught with great danger, as they had lodged in the immediate vicinity of blood-carrying sinuses of the brain. The surgeon nevertheless decided to operate. When the splinters were removed, blood began to gush profusely from the sinuses, but in both cases swabs steeped in thrombin and inserted into the apertures of the wounds quickly stopped the blood flow. When the swabs were removed bleeding was not resumed and recovery proceeded rapidly. One of the men had his skull shattered in the region of the temple and part of the brain protruded in the form of a large blood-filled swelling. Cutting the swelling would have caused profuse bleeding. The surgeon injected a small quantity of thrombin with a syringe. The protruding part of brain was then opened and the blood removed in the form of a clot. There was no further bleeding and the operation was quite dry.

In the short period thrombin has been in use there have been numerous instances of this kind. It has proved a valuable means not only of saving blood but also lives of wounded men. The effect of this blood-stopping preparation in no way differs from natural blood clotting. When applied locally thrombin merely accelerates blood clotting—ten and in some cases even one hundred times without, moreover, deleterious effects on the wound or on the patient. It is absolutely harmless.

Production of thrombin has now been placed on solid industrial lines on a scale fully adequate to meet the demands of the front.—Cable from Russia by Boris Kudryashov.

ITEMS

For the second time within the year, a Finnish woman astronomer, Miss L. Oterma of Turku Observatory, has discovered a new comet. This one is in the constellation of Taurus, the Bull, and it is 13th magnitude, much too faint to be seen without telescopic aid. The new comet is near the celestial equator and moving northward. It is not far from the famous star cluster, the Hyades, shaped like a V, which rises in the eastern sky early these autumn evenings. More observations and considerable mathematical computations will be necessary before it is determined whether the new comet will become brighter.

A new test that tells more exactly the spot for operation on the back in cases of sciatica and low back pain is reported by Dr. Walter E. Dandy, of the Johns Hopkins Hospital, in the forthcoming issue of the *Journal* of the American Medical Association. In almost all cases of sciatica with low backache, the trouble is due to rupture or defect of an intervertebral disk, the layer of fibrocartilage between the bodies of the vertebrae. Treatment by operation is "absolutely safe and a cure is practically assured." The diagnosis, he believes, can be made solely on the patient's story of attacks of sciatica and low backache occurring after a relatively trivial injury, such as a lift, bend or strain, with the pain made worse during attacks by coughing or sneezing. In almost all cases the affected disks are at the fourth or fifth lumbar vertebra.

Announcement that the National Foundation for Infantile Paralysis had 100 per cent. wool available for patients getting the Kenny treatment resulted in a deluge of requests to headquarters. Consequently the foundation now announces that the wool can only be shipped to hospitals where the need is immediate, that is, where patients in the early stages of infantile paralysis are actually under treatment when the request is made. The material, available through the cooperation of the National Paperboard Association, can not be shipped in anticipation of cases that may occur in the future. In communities where there are only one or two cases, it is suggested that sufficient material, such as old blankets, lightweight woolen suiting and the like, can be obtained without calling on the supplies of the foundation. An average of five pounds of woolen material is required for each patient. Those requesting it from the foundation are asked to order only as much as is needed.

SCIENCE

VOL. 96 | FRIDAY, DECEMBER 4, 1942 | No. 2501

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

POSTPONEMENT OF THE NEW YORK MEETING

By Dr. F. R. MOULTON
PERMANENT SECRETARY

IN compliance with a direct request of the Office of Defense Transportation, an agency of the Federal Government, the meeting of the American Association for the Advancement of Science and of 44 of its affiliated and associated societies that was scheduled to be held in New York City beginning next December 28 has been postponed, by vote of the Executive Committee. The reason for the request from ODT is the excessive demands on railroads due to the war efforts of the country in general, and to the greatly added burdens due to recent military developments in particular.

Naturally the postponement of a meeting implies that it will be held at a later date. In the present case, however, no definite plans for the future have been made or can be made until the acute transportation problems now existing have been at least partially solved. It is not possible to predict how soon the transportation conditions will improve; as soon as they are improved the ODT will not discourage the holding of scientific meetings.

Instead of drifting, and possibly grumbling, until the future of scientific meetings is clarified, scientists may well consider in all seriousness how their meetings might be improved. Presumably they can be improved in many ways, and if some of the ways of improving them can be discovered during this interval of uncertainty, the disappointments and irritations due to the postponement of the New York meeting will be forgotten.

WARTIME CHEMICALS FROM NATURAL GAS[1]

By Dr. GUSTAV EGLOFF

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PRESIDENT, AMERICAN INSTITUTE OF CHEMISTS

FOR many years natural gas has been used mainly for heating and generation of steam and electrical power. In the last few years, however, the tempo of research and development has increased enormously. A much higher field of utilization for natural gas than as fuel is seen in the conversion of the hydrocarbons into superior aviation gasolines, lubricants, synthetic rubber, explosives, acetylene, anesthetics, plant life promoters, plastics, solvents and many other chemical derivatives. A vast supply of these derivatives is available in natural gas produced in this country.

The processes and methods for such conversion in some instances are already in commercial use in the petroleum refining and other industries. Other methods have been worked out in the research laboratories and the processes and yields that can be achieved are known; but it remains necessary for further research to establish the means to reduce costs to the level of commercial practicability. Another wide avenue for future development in the natural gasoline and refining industries is thus foreseen.

Natural gas is consumed at the rate of over 2.6 trillion cubic feet per year. The United States has proven reserves of 85 trillion cubic feet and another 35 trillion as potential reserves. The yearly consumption of natural gas is equivalent in fuel value to 100,000,000 tons of coal or over 500,000,000 barrels of fuel oil.

In the Axis countries, methane gas is a widely used substitute motor fuel. As a matter of fact, there are over 107,000 compressed gas (methane, ethane, propane, butanes) propelled motor vehicles operating in continental Europe, which conserved about 2,300,000 barrels of gasoline for military use. The compressed gas is sold at filling stations in exactly the same way as gasoline in the United States. The gases are compressed under pressures up to 5,000 p.s.i. into steel cylinders attached to the running board of the car or under the floor of trucks and buses. Italy has a number of natural gas wells and is operating many buses and trucks plus a number of locomotives on methane gas. This looks like a desperate measure, since it requires on the average about 135 pounds of steel for each of these high-pressure steel alloy cylinders in order to withstand the high pressures. The products of fermentation of sewage are also used as a source of methane gas in Germany. Methane from coal gas is used for running motor vehicles of one sort or another in many of the European cities. Many coal hydrogenation units produce gasoline in addition to methane, ethane, propane and butanes by the Bergius and Fischer-Tropsch processes. The latter process will be referred to later in more detail because it is a potential source of many products. Buses, trucks, tractors and power shovels, totaling over 25,000 in the United States, use compressed propane and butane. One truck company has liquefied butane functioning in a dual role as a refrigerant for fruits and meats and as motor fuel for the truck after the cooling has taken place.

Hydrocarbons present in natural gas are methane, ethane, propane, butanes, pentanes, hexanes and heptanes, etc. The first four of those are gases, while from pentane on they are liquids useful as gasoline.

The individual hydrocarbons have a variety of uses in a number of industries. Propane has been suggested for use as a fuel for breaking in aviation engines on the "test block" since it has a high octane value and is readily available. Such a procedure would conserve the 100 octane liquid fuels needed for fighter, bombing and cargo airplanes in the war effort. Other uses for propane which have gained wide commercial application are as refrigerants and solvents in the refining of lubricating oils. Paraffin wax, asphaltic substances, naphthenic hydrocarbons and other materials are eliminated from lubricants when propane is used as the solvent. Over 50 per cent. of the world's lubricating oils are improved in quality by the use of propane.

Two hydrocarbons present in natural gas of great utility are isobutane and isopentane. Isobutane is the key hydrocarbon in the production of aviation gasoline by alkylation with olefins. In general, there is not enough isobutane available, hence it has been necessary to isomerize the normal butane present in natural gas to the iso compound. A number of commercial installations are in operation and under construction to isomerize normal butane to isobutane. Normal and iso pentane are also present in natural gas, and it is highly desirable to fractionate out the iso compound due to its 91 octane rating in contrast to the normal, which has an octane number of 64. Isopentane is blended with aviation gasoline in percentages ranging from 10 to 20, depending upon the other components in the final blend.

Olefinic hydrocarbons, not contained in natural gas as such, are important for many reactions not alone

[1] Address before the American Institute of Chemists, Chemists' Club, New York, N. Y., October 23, 1942.

for aviation gasoline but for synthetic rubber and a host of other products. There are several routings to produce olefins from natural gas: one is high temperature, and the other by catalysis. The olefinic hydrocarbons which are now in great demand are ethylene, propylene, butylenes, pentylenes and butadiene. Natural gas, particularly the propane-butane fraction, when subjected to high temperature cracking, produces ethylene, propylene, butylenes and butadiene. Normal butane is readily converted into butadiene in one or two stages by catalytic means at high temperature with yields reported of over 60 per cent.

A branched chain paraffin, isooctane, is of great importance in the aviation fuel program. There are two methods whereby this hydrocarbon is derived—one is by polymerization, in which isobutylene is polymerized to a dimer in the presence of phosphoric acid as a catalyst. Isooctene is the product, and upon the addition of hydrogen, isooctane results. Isooctane has an octane rating of 95–100. Another method of producing aviation gasoline is to polymerize the propylene, butylenes and pentylenes present in cracked gases to a polymer gasoline under selective conditions which upon hydrogenation yields an aviation gasoline blending product of 90 octane rating.

The polymerization process has been largely replaced by the alkylation process in which isobutane is alkylated by butylenes in the presence of sulfuric or hydrofluoric acid catalysts. The resulting alkylate ranges in octane value from 91 to 96. The simplest of the olefins is ethylene, which is used to alkylate isobutane at temperatures in the order of 950° F. and pressures up to 5,000 pounds. This reaction produces neohexane having an octane rating of 94, an important hydrocarbon for aviation gasoline. In addition to alkylating ethylene and butylenes, propylene and pentylenes are also being alkylated with isobutane to form additional quantities of high quality aviation gasoline. It is proposed in some type of operation to utilize the mixtures of propylene, butylenes and pentylenes in the alkylation reaction with isobutane using hydrofluoric acid as alkylating catalyst to produce alkylate of 91 octane rating highly suitable for aviation gasoline blending stock.

An important aviation blending fuel of an entirely different type is cumene, which is produced from the alkylation of propylene and benzene in the presence of solid phosphoric acid. A number of commercial units are now in operation.

Normal hexane and heptane are two hydrocarbons which from a motor fuel standpoint are practically worthless unless their molecular structure is changed. Normal heptane has a zero octane rating and hexane about 25. These straight-chain paraffin hydrocarbons, hexane and heptane, can be changed in configuration and also in their properties to improve their antiknock properties. Hexane and heptane can also be converted into benzene and toluene—two important hydrocarbons for high explosives. Benzene is of vital importance in the production of styrene, which is produced by the alkylation of benzene with ethylene forming ethyl benzene. Dehydrogenation of this compound yields styrene. When styrene (25 per cent.) and butadiene (75 per cent.) are mixed in the presence of a catalyst such as peroxide, polymerization takes place to form the synthetic rubber Buna-S.

The synthetic rubber program in the United States calls for 886,000 tons as planned in September, 1942, distributed as follows:

Types	Tons
Buna-S	705,000
Butyl	132,000
Neoprene	49,000

However, the recommendations of the Baruch Committee called for an increase of 220,000 tons to be apportioned as:

Types	Tons
Buna-S	140,000
Neoprene	20,000
Thiokol	60,000

Out of the total 886,000 tons of synthetic rubber planned for the United States, 705,000 tons of it will come from butadiene and styrene. The normal butane that will be used for butadiene will represent about 80,000 tons a year derived largely from natural gas. One plant has a rated capacity of 66,000 tons and the other 15,000 tons a year.

More than 100,000 barrels a day of normal butane are available from natural gas. If this were used just for butadiene making, it would satisfy the entire butadiene requirements in our present synthetic rubber program. Hence, it can be seen that the natural gas industry has more than enough of the hydrocarbons which can be converted into raw materials to supply the entire synthetic rubber program. Another important source of butadiene is through the dehydrogenation of butylene derived from catalytic cracking. This source will yield at the rate of 283,000 tons annually.

Another type of synthetic rubber is called Thiokol, made by chlorination of ethylene, which is then refluxed with sodium polysulfide. The synthetic rubber program calls for 60,000 tons of Thiokol yearly. Hydrogen sulfide is present in varying percentages in natural gas and is readily converted into flowers of sulfur. This sulfur may react with caustic soda to produce sodium polysulfide. After reacting ethylene with chlorine, the dichlorethane is formed which reacts with the polysulfide yielding Thiokol. The plans call for the use of Thiokol in retreading of tires.

Besides butadiene, styrene and ethylene, a hydrocarbon of great importance is acetylene used in the production of the synthetic rubber, neoprene; it is also the base material for nylon, a replacement product for silk. Calcium carbide is produced from coal and lime in electric furnaces requiring much electrical power. When water is added to this compound, acetylene is formed.

Natural gas or products therefrom under high temperature conditions yield acetylene readily. Two commercial acetylene units are being installed at the present time, one of which will produce at the rate of 75 tons per day or 27,000 tons a year. Other units are also under way. The charging stock may be either propane, butane, natural gasoline or fractions from petroleum. It is believed that acetylene can be produced at a lower cost from processing natural gas than by the electrochemical method of producing calcium carbide. The natural gas industry has enormous volumes of propane and other hydrocarbons available to supply the whole needs of the United Nations for acetylene and its derivatives.

Germany uses acetylene made from calcium carbide, converting it into butadiene by a four-stage chemical process. Neoprene rubber is made from acetylene treated with hydrochloric acid. This type of rubber will be produced at the rate of 49,000 tons a year in the United States.

The Russians start primarily with ethyl alcohol from grain to produce butadiene. Butadiene from ethyl alcohol derived from grain will be one of the sources in the United States synthetic rubber program. The tonnage of butadiene from grain alcohol will be at the rate of 242,000 a year, representing about one third of the Buna-S type production.

There are several other types of rubber which are in commercial production, one of which is the type based on isobutylene from dehydrogenation of isobutane from natural gas or from cracking of oil. Isobutylene is copolymerized with about 2 per cent. of butadiene or isoprene, resulting in a product called Butyl rubber. In the government program this type of rubber will be produced at the rate of 132,000 tons a year. Butyl rubber, as of to-day, is not as good a synthetic rubber for tire use as the Buna-S. Tires made of Butyl rubber have a mileage life of about 12,000 miles with a maximum road speed of thirty-five miles an hour. This will naturally be improved upon.

There is an important use for synthetic rubber which is fabricated so that billions of minute air cells are present; it is used as a liner in gasoline tanks in fighting, bombing and pursuit planes. When a bullet goes through the tank, the rubber causes it to be self-sealing.

Another type of synthetic rubber is the acrylonitrile butadiene which can be produced also from natural gas and is known as Buna-N or Perbunan.

One of the necessary materials in the compounding of either natural or synthetic rubber is carbon black, which is made from natural gas. Carbon black is an important component in tires or other rubber goods whether it is blended with natural or synthetic rubber, as the properties of rubber, particularly from the standpoint of the tensile strength and wearing qualities under service conditions, are greatly improved. During the year 1940 about 369 billion cubic feet of natural gas were converted, largely by the channel process (air oxidation), into carbon black with an average of 1.54 pounds per cubic foot of gas or about 285,000 tons, of which about 85 per cent. was used in tires. Furnace black appears to be superior for use in synthetic rubber.

The world's natural rubber production for 1941 was about 1,675,000 long tons, of which the United States imported over 800,000 long tons. The United Nations have lost over 95 per cent. of the world's natural rubber sources and Russia has lost two of its synthetic rubber plants in the Ukraine.

With the tremendous increased demand for airplanes, tanks, motor trucks, ships, trains, gun mountings, etc., rubber is required in ever-increasing quantities by both the fighting forces and the necessary civilian users for the successful conclusion of World War II. A medium-sized tank requires 500 pounds of rubber, small pontoon bridges, 1,000 pounds; for flying fortresses the gasoline tank alone requires 500 pounds of bullet-sealing rubber, while a large bomber uses 1,250 pounds, gas masks 0.75 pounds, and battleships between 75,000 and 150,000 pounds. Tires for large excavation trucks used by the Army have a diameter of 9.5 feet and weigh over 3,500 pounds. There are many hundred more products requiring rubber that are vital in the war effort, such as blimps, barrage balloons, rubber boats, rafts and life vests and suits for flyers, hospital rubber needs, etc. Millions of soldiers on the fighting fronts require rubber in one form or another.

The synthetic rubber picture in the United States, with its 886,000 tons a year at plant costs of about $800,000,000 is already well under way. The Baruch Committee has recommended that this tonnage be increased to 1,106,000 tons a year. In addition to being the arsenal for many other war products, synthetic rubber will also have to come from the United States to supply our allies' needs. It may well be assumed that even 1,106,000 tons of synthetic rubber will be too low for the United Nations' requirements.

The question arises now: Is the synthetic rubber product equal to the natural? In general, one can say

that synthetic rubber is at least equivalent to the natural; the chemist's goal is not necessarily to synthesize a duplicate of natural rubber, but it is certain that whatever properties rubber has that are needed will not only be duplicated, but radically improved and new ones added. Synthetic rubber is superior to natural rubber in gasoline, oil and chemical resistance. The synthetic product is more stable to light and air, and has greater wearing properties. Some trucks using synthetic rubber tires have gone over 35,000 miles. Sidewall tire strength is greater, meaning greater safety and better road gripability. The latter property has been tested out thoroughly on wet and muddy roads. Tests on hills with different trucks have shown that the synthetic rubber-tired vehicle goes up a hill with very little side-slipping, whereas the tires of natural rubber slipped all over the road. On curves when operating the car at high speeds, the synthetic tire is safer than the natural.

(*To be concluded*)

INFLUENCE OF THE ENVIRONMENT ON THE EXPRESSION OF HEREDITARY FACTORS IN RELATION TO PLANT BREEDING[1]

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ENVIRONMENTAL influence on the expression of hereditary factors has many aspects. To the geneticist this is the cause of non-hereditary variation. To the experimental taxonomist it helps to explain the status of geographic races. To the breeder it may represent the opportunity to provide adaptability. To the horticulturist interested in cultural problems, differential varietal response to the environment is being increasingly recognized as an important factor in making cultural recommendations. Each aspect has as its fundamental basis the response of the hereditary factors or genes, either singly or more commonly in groups, to the many conditions external to the organism, under which it develops. These outside influences are usually rather complex and difficult to control experimentally. Those most frequently studied are temperature, light intensity and duration, soil and air moisture, wind movement and a variety of nutritional factors.

One of the first careful studies of the effect of the environment on the expression of the gene was made by T. H. Morgan and reported by him in 1915. A strain of Drosophila was found in which the abdomen was defective. This was shown to be sex-linked and to be due to a single mendelian factor. The remarkable thing about it was that only the flies that hatched while the colony was young had the defect, while flies emerging later were normal in every respect. By suitable tests it was shown that flies developing from larvae whose food had been moist had the defective abdomen, while flies whose larval stage was spent on drier food were normal.

[1] Condensed address of the retiring chairman of the Southern Section of the American Society for Horticultural Science, presented at the Memphis meeting on February 5, 1942. Citations to literature have been published with the complete paper in Volume 41, Proceedings, Amer. Soc. Hort. Sci., 1942.

A second component of the environment that has received considerable attention from the geneticists working with fruit-flies is temperature. Zeleny in 1923 showed that an increase of 1° C. during the larval stage decreases the number of facets of bar eye by 10 per cent., of ultra-bar by 8 per cent. and of normal flies by 2.5 per cent. He pointed out that the same effect can be obtained either by increasing the temperature or by adding another bar gene.

Passing on to another insect, the Hymenopterous parasite of the oriental fruit moth (*Trichogramma minutum*) consists of several morphologically similar races that carry different factors for body color which are entirely dependent upon an appropriate temperature for their expression. According to Peterson, when the average daily temperature exceeds 62° F. the females of one race have a distinct lemon-yellow body color, but when the temperature drops below this average these same individuals become a metallic brown. Flanders finds that four races of this parasite can be identified on a basis of color when raised at the same temperature, but when raised at different appropriate temperatures they are indistinguishable. Temperature with this insect not only affects body color but also influences the length of the life cycle, an important character in determining adaptability to climate.

The effect of temperature on the expression of hereditary factors is by no means limited to insects. In Canna, Honing finds that the anthocyanin pigment producing "old purple" is recessive to another factor for yellow. Plants that are homozygous recessive for old purple and heterozygous for yellow (ssWw) are completely yellow during the heat of summer, but later flowers of the same plant developing during cool weather in the fall have a bluish cast. *Primula sinensis* has a form in which the flower is re-

at 20° C. but white at 30°. A genetically distinct type has a white flower at both temperatures.

The effect of low temperature on the flowering of biennials depends upon (a) the temperature employed, (b) length of time exposed, (c) stage of development, (d) kind of plant, (e) photoperiod and (f) later growing conditions. All of us are familiar with the necessity of many fruits and ornamentals for cold during the dormant period in order to bloom and fruit normally in the spring. Varieties differ widely in their cold requirements. The use of cold in vernalization treatments to hasten fruiting would seem to be a variation of this same theme. The bearing of these differential responses of plant varieties to heat or to cold on the problems of plant breeding may not be immediately evident to those who handle plants in an environment for which their crops have long been bred or selected. Once these plants are grown outside of their accustomed environment the necessity for hereditary factors that will permit them to grow and produce as an economic crop are soon apparent.

The same may be said of the responses of plants to light. The literature concerning the reactions of plants to photoperiod has become rather extensive. The interest of southern plant breeders in this subject arises from the shortness of the days experienced during both summer and winter compared to the day-length of the normal growing season farther north where many of our commercial varieties were developed.

Often environmental factors other than or in addition to temperature and light make a significant contribution to the appearance or behavior of a plant. Platenius and Knott found that onions on peat are twice as pungent as those grown on sand, and onions on loam are intermediate in this respect. Pungency tends to increase with increased temperature. More sulfur in the soil increases pungency, but more soil moisture decreases it. In spite of these environmental effects, with comparable conditions some varieties are three times as pungent as others.

Available sugars inside the plant are an important factor in the formation of anthocyanin pigmentation. Environmental factors influencing the accumulation of sugars therefore affect plant color. These include soil nutrients, light, temperature, water, available nitrogen and altitude. Owen reports increased mottling of soybean seeds on heavy, rich soil, and sometimes with wider spacing, while increased nitrogen decreased mottling. Ratsek has been able to reduce the intensity of color of red roses to nearly white by defoliation and by pruning away carbohydrate reserves.

Work on the manipulation of a multitude of nutritional factors has now assumed enormous proportions. It is all based on the assumption that the complex of hereditary factors affecting growth and yield are influenced in their expression to a considerable degree by the environment. To return to Drosophila, the vermillion brown stock lacks the amount of eye pigment of normal flies. When the 70-hour larvae are placed on a partial starvation diet the intensity of color is greatly increased. It is estimated that this treatment stimulates the production of the eye color hormone by "not less than a hundredfold" according to Beadle, Tatum and Clancy. In studying a stock of the bent nose Norway rat in which about half of the individuals had this defect when fed a home-made diet, Heston was surprised to get only normal rats when the stock was placed on Purina Fox Chow. It was found that a certain calcium-phosphorus ratio and vitamin D do not allow genes for bent nose in the rat to express themselves.

Work on the effect of nutrients on the fruiting of plants has produced rather striking results. Many fungi are induced to produce sexual spores on artificial media only with great difficulty or not at all. Sax grew field beans with white and with colored seed coats on rich and on poor soil. Factors linked with color gave the higher yield under unfavorable conditions, while factors linked with white seed gave a higher yield under favorable conditions.

A somewhat different type of effect of environment on gene expression is found in its influence on disease resistance. Walker and Smith report a decreased resistance of commercial varieties of cabbage resistant to yellows, with increased soil or air temperature to 28° C. It would seem that both host and pathogen might share in this measurable response in their relationship.

For plant breeders faced with problems of adaptability, as many of us in the South and West are, a good deal of the work in experimental taxonomy has a direct bearing on our problems. It makes no real difference whether the characters that fit a plant for a particular environment are inherited under other conditions or not. Whether the valuable characteristic represents an "environmental variation" from what may be considered the normal type elsewhere, or represents a new genetic combination that can maintain its individuality under other conditions makes a difference only if the climatic conditions the plant breeder faces are so variable that the usefulness of the so-called "environmental variation" is nullified. One of the difficulties in discussions of this kind is the almost universal human error of assuming that the familiar is the only true norm and that all other forms are "off-type." This suggestion obviously has its limitations, as the familiar tends to be the modal type, and environmental variation as observed in the laboratory or under field conditions tends to be continuous. In the widest sense, distinct forms resulting from the

interaction of a genetic complex with contrasting environments do have genetic meaning both for the taxonomist and for the plant breeder.

The problem of adaptation among both wild and cultivated plants is a matter of finding genes whose expression under a particular set of conditions favor growth and maintenance. The essential differences in the two cases lie in the numbers of individuals involved, in the methods of selection and to no small extent in the economic motivation of the breeder. A better understanding of the processes of nature should be of value to the latter.

Vavilov has developed the idea of parallel variation among geographic races and species, calling this the "law of homologous series in variation." He suggests that where plant breeders observe adaptive characteristics in species related to the material they are working with, there might be a reasonable chance of finding or developing the character from their own or the more closely related wild material. The crossing of genetically distinct geographic races may make it possible to transcend the limits of ordinary types.

The work of Massart provides an example of very marked response of a single genotype to different environments. *Polygonum amphibium* may be readily adapted as a land plant, a water plant or a dune type merely by growing divisions of a single individual under these distinct conditions. Each one would be considered a definite geographic race, which is the normal type for each environment.

In discussing the origin of genes responsible for well-adapted climatic races Goldschmidt credits Davenport and Cuenot with the suggestion that genes useful in a new environment arise by mutation and may be carried along by chance until they have an opportunity to express themselves and contribute to the survival of the species under the new conditions. This has been called preadaptation. He even goes so far as to say ". . . we must regard such preadaptational mutations as a prerequisite for the spreading of a species into new areas with different conditions, which would be inaccessible to the original forms. . . ." White discusses the possibility of the existence of genes for cold hardiness among tropical species and those having a southern range. He cites the case of a native Texas pecan that was found to be fully hardy in Canada. Three species of Iris native to Texas proved to be hardy in New York. Occasional mutations for hardiness in tropical plants are likely to be lost if there is no change of climate to give them selective value.

There may be a lesson for the plant breeder in Fisher's theory of the origin of dominance. He supposes that most mutations originally have some effect in the heterozygous condition, *i.e.*, they are partially dominant to their wild-type allel. As this effect is unlikely to be beneficial to the organism, any combination of genetic factors tending to cover up the effect of the new gene will have survival value, and eventually this will become the normal wild type with the new gene fully recessive. Such a complementary effect might be made use of by the plant breeder in outcrosses of valuable but not fully adapted material to secure new genetic combinations that favor the development of the desired characteristic under a particular set of environmental conditions. The value of such a method will depend entirely upon the material available. It should be remembered that the breeding situation among the crop plants is different from that among wild species both in the matter of the effective number of breeding individuals and in the basis of selection. The opportunity for crosses with wild types in many instances permits the incorporation of such recessive genes in the plant breeder's stocks.

Some of the most important characteristics the plant breeder interested in adaptability has to deal with may be classed as physiological. Nilsson-Ehle found that an apparently uniform variety of wheat would become more resistant to cold through the natural elimination of those individuals with genetic factors for tenderness. McKinney and Sando have crossed spring wheat, which requires long warm days, with winter wheat, which first needs cool short days. In order to classify the segregation in the F_2 they found it necessary to grow populations both in the spring and in the fall. Heyne and Laude have tested the resistance of inbred lines of corn to high temperature in the laboratory, securing differential response that checks with field experience. They conclude that "the testing of seedlings for heat resistance can be relied upon with considerable assurance for distinguishing genetic differences in the drought tolerance of larger plants of different strains of maize." Hawthorn has been able to select lines of Bermuda onion less apt to split and double. The point of chief interest to us in connection with this work on wheat, corn and onions is that varieties that are to all appearances entirely uniform, do carry valuable hereditary factors that can express themselves only under suitable environmental conditions.

Before drawing the moral for plant breeders inevitable to such a discussion as this let us review briefly some of the points that have been made: (1) single mendelian factors that have been studied genetically have been found to vary widely in their expression because of differences in environmental conditions; (2) under one set of conditions it may be impossible to distinguish between distinct genetic types while under other conditions they may be quite different in appearance; (3) factors of the environ-

[illegible] are responsible for these differences include moisture, temperature, light, nutrition and many geographic and cultural conditions that affect these things; (4) there must be appropriate environmental conditions before any gene or combination of genes can have selective value, either natural or in plant breeding, otherwise they may be entirely lost; (5) in tests, suitable conditions may have to be provided artificially; (6) the cumulative effect of modifying factors under a particular set of environmental conditions can be taken advantage of by the plant breeder in improving the adaptability of selections having special market appeal; (7) the value of any heritable character under a particular set of conditions may bear no relation to its development or lack of development under other environmental conditions; (8) work in experimental taxonomy encourages the belief that the adaptability of many crops for southern and western conditions can be materially improved by breeding and selection even though they have been developed primarily for other regions with quite different conditions; (9) improvement might be expected in some cases through intervarietal crosses by accumulating genes from different varieties that may have a favorable effect directly or in combination; and finally (10) in other cases more rapid progress may be expected by outcrossing to wild forms where these are available or by making wide crosses among cultivated forms. Perhaps this summary carries its own moral. As a matter of fact much of the breeding work in the South and Southwest has been and still is in line with these considerations.

This interest in breeding for increased adaptability to southern conditions evident in the past ten years is very encouraging. As the work progresses we may expect an even larger accumulation of hereditary factors favoring quality and production under our conditions. This will make it increasingly easy to synthesize a variety according to certain specifications. There is still a good deal of spade work to be done. This means that we must discover new genes judging their value to us not by their expression under a different environment, but by what they can do under conditions peculiar to our own locality, both as individual hereditary factors and in new combinations. With these it seems reasonable to expect that we can provide the plant material basis for an increasingly prosperous southern horticulture.

SCIENTIFIC EVENTS

RECENT DEATHS

Herman Stabler, since 1925 chief of the conservation branch of the U. S. Geological Survey, died on November 24, at the age of sixty-three years.

Dr. Reuben Peterson, until his retirement in 1931 with the title emeritus for thirty years professor of obstetrics and gynecology at the University of Michigan, died on November 25, at the age of eighty years.

Dr. Samuel Hanford McKee, ophthalmologist at the Montreal General Hospital, formerly clinical professor of ophthalmology at McGill University, died on November 25. He was sixty-seven years old.

A recent message received through the American Red Cross announces the death in Germany on July 5 of Professor Oskar Bolza at the age of eighty-five years. He was a reader in mathematics at the Johns Hopkins University in 1888–89, associate at Clark University, 1889–93, associate professor at the University of Chicago, 1893–94, and professor, 1894 to 1910. For many years past he had been non-resident professor living in Freiburg.

Dr. Richard B. Goldschmidt, professor of zoology at the University of California, writes: Mrs. L. Goldschmidt, widow of the crystallographer, Professor Victor Goldschmidt, of Heidelberg, who had been professor there for about forty years and had bequeathed his fine art collection with a large endowment to Heidelberg University, recently committed suicide at the age of eighty-two years, when the Nazis wanted to deport her to a Polish ghetto.

TRANSFER TO THE UNITED STATES OF THE HEADQUARTERS OF THE INTERNATIONAL SOCIETY OF SURGERY

By a vote of the delegates from all the affiliated societies of the Americas, representing Argentina, Brazil, Canada, Cuba, Ecuador, Guatemala, Mexico, Paraguay, Peru, the United States, Uruguay and Venezuela, the headquarters of the International Society of Surgery has been provisionally transferred from Brussels to the United States.

In explaining the need for the change Dr. Rudolph Matas, of New Orleans, acting secretary and treasurer, said:

> The German occupation of Belgium and the Nazi devastation of the rest of Europe and all the other war-torn nations had virtually restricted the international relations of the society to the Western Hemisphere, where its fellowship is widely spread through its affiliated branches in North, Central and South America.
>
> The Executive Committee of the United States Division, the largest, most active contributor to the transaction, felt it their duty conjointly with their Latin American colleagues to rescue the society from the perils of the Euro-

pean conflagration. The first steps were taken in November, 1941, at Boston, but no final action could be taken to transfer the official sanction in Brussels to America without the concurrence and approval of all the affiliated branches in America.

The act by which the transference of the society was effected was signed either personally or by proxy by the delegates from all the affiliated societies of the Americas.

By action of the Council of Delegates, the official seat of the society will be established in the Inter-American Division of the New York Academy of Medicine, directed by Dr. Mahlon Ashford, where Dr. Enrique J. Cervantes, assistant secretary-treasurer of the executive committee, editor of *America Clinica,* the official organ of the society, and editor and secretary of the Hispanic-American Medical Society, will be able to render service to the fellows of the society and to medical visitors coming from the Latin American countries.

The affairs of the society will be administered by an executive committee composed of Dr. Elliott C. Cutler, Col. M. C., U. S. Army, *chairman in absentia,* Dr. Eugene Pool, Dr. Arthur W. Allen and Dr. Matas.

A meeting held on February 12 was presided over by Dr. Eugene Pool, who serves as acting chairman of the executive committee for the United States, in the absence of Colonel Elliott C. Cutler, now at the front. Dr. José Arce, dean of the University of Buenos Aires, is serving as acting president in the absence of Professor L. Meyer, of Brussels, detained in Belgium by Nazi compulsion.

A revision of the constitution prepared by Dr. Matas was adopted in November and a representative group of fellows from New York and elsewhere signed the act of reorganization, as witnesses of the signing of the act by the delegates of the governing council. These included Dr. Mahlon Ashford, director of the Inter-American Division of the academy, and Dr. Archibald Malloch, librarian of the New York Academy of Medicine; as fellows and guests were Drs. Walter Estell Lee, of Philadelphia; Russell S. Fowler, Ralph Colp, Edwin G. Ramsdell, Frederick W. Bancroft, Howard Lillienthal, Charles Elsberg, Seward Erdman, Carl Eggers, Henry Lyle, and others elsewhere by proxy.

GENETICS IN THE U. S. S. R.

Following are the essential parts of a letter written to Dr. M. Demerec, the Carnegie Institution, Cold Spring Harbor, New York, by Dr. S. Gershenson at Ufa, U. S. S. R., on July 6, and received by registered mail on November 20:

My laboratories, both in the Institute of Zoology of the Academy of Sciences of the Ukranian S.S.R. and in the Kiev State University were, like all other scientific institutions, safely evacuated from Kiev. At present the first of them, where I am working, is in Ufa (Ural), the second in Kzyl-Orda (Middle Asia). All our laboratory equipment is with us, but we lost all our Drosophila stocks, among which were some very valuable ones (*e.g.*, a collection of over 100 mutant genes of *D. buscki,* most of which were already mapped, collections of mutant genes from wild populations of *D. funebris, D. melanogaster,* etc.), and both our laboratory and private libraries are also lost. This latter loss is especially painful, and I should be greatly obliged to you and to all American geneticists whom I would kindly request you to inform on the subject, for sending of not only the reprints of new works appearing out of press, but also for sending of all old reprints which you can spare. . . .

At present we are actively occupied with selection, breeding and genetics of the oak silk-worm and of cattle. Besides this work on economically important objects, I continue to study the distribution and dynamics of melanism in the hamster—a work that I have been leading during the last three years, and which has already given some interesting results concerning the mechanism of natural selection and the origin of lower taxonomic units. I am also working on some theoretical genetical-evolutionary questions.

Please extend my best regards to my colleagues. Kindly tell them as well as other American geneticists that we are trying here to help all we can in the great fight against fascism and that we unanimously believe in a complete victory over our common foe. We all greatly welcome the recent agreement between U. S. A. and U. S. S. R. and trust that it will lead, among other important results, also to the further development of scientific relations between our countries.

Information received from the Embassy of the U. S. S. R., in reply to inquiries, indicates that books and reprints can be sent by mail in small packages addressed directly to the Academy of Sciences of the Ukranian S. S. R. in Ufa. If, however, the material is very bulky and can only be sent in packing cases, it would be advisable to send it by sea. In that case, the Embassy will be glad to send shipping directions if the weight and dimensions are supplied.

THE ST. LOUIS MEETING OF THE AMERICAN SOCIETY OF AGRONOMY

The thirty-fifth annual meeting of the American Society of Agronomy was held in the Hotel Statler in St. Louis, Missouri, on November 11, 12 and 13. There were 393 members and guests registered in attendance. The meetings were held jointly with the Soil Science Society of America.

A general meeting was held on the morning of November 12, with President Richard Bradfield presiding. Papers were presented by Dr. O. S. Aamodt and by Dr. Frank W. Parker, of the Bureau of Plant Industry. Following these papers a committee

composed of Dean M. F. Miller of Missouri, Dr. L. F. Graber of Wisconsin, and Dr. R. D. Lewis of Ohio led a round table discussion on "The American Society of Agronomy and the War." The annual dinner was held in the evening, at which time President Richard Bradfield delivered his presidential address. The Crops Section had one general program and eleven subsectional meetings. Thirty-four papers were presented and conferences held on Statistics, Teaching, Alfalfa and Corn Improvement.

The Soil Science Society had one general program and thirteen sectional programs. Eighty-two papers were presented. In addition to formal papers there were discussions of Soil Survey Techniques, Problems of Soil Classification and the Contribution of Soil Survey to the War Effort and Post-war Planning. The annual banquet was held on Wednesday evening, when D. Howard Doane, of the Doane Agricultural Service, St. Louis, gave the address.

A meeting of interest to members of both societies was held on Friday morning. At this session five papers were presented on the general topic of "Cropping Practices in the Great Plains."

Vice-president F. D. Keim, of the Society of Agronomy, announced the names of the fellows elect and presented certificates at the annual dinner. Frank W. Parker was elected vice-president of the society.

THE UPPER PENINSULA MINERAL RESOURCES CONFERENCE

THE Upper Peninsula Mineral Resources Conference was held on November 21 at the Michigan College of Mining and Technology, Houghton, with five federal representatives in attendance. The conference was planned to study exploitation and utilization of the mineral resources of northern Michigan.

The U. S. Geological Survey was represented by Drs. W. S. Burbank, J. J. Runner and C. F. Park, Jr.; the U. S. Bureau of Mines by E. F. Fitzhugh and District Engineer E. P. Barrett; the Michigan Geological Survey by its director, Dr. R. A. Smith; the University of Michigan by Professor K. K. Landes, head of the department of geology; Michigan State College by Professor S. G. Bergquist, head of the department of geology and geography; the University of Minnesota Mines Experiment Station by Director E. W. Davis; the Michigan College of Mining and Technology by a large number of faculty members; and mining companies by their chief geologists, mining engineers and other officials.

The address of welcome was given by President Grover C. Dillman, of the institute. The introductory session was conducted by Dr. Smith. The luncheon address on "Lake Superior Iron Ore and the War Emergency" was delivered by Mr. Davis.

Committees appointed included those on copper ores, iron ores, mineral dressing, non-metallics, geophysical prospecting, federal and state cooperation and planning, and university and college cooperation and specialization.

The chairmen and co-chairmen included Messrs. Burbank, Fitzhugh, Smith, Landes, Bergquist and Dr. T. M. Broderick, chief geologist of the Calumet and Hecla Consolidated Copper Company; E. L. Derby, Jr., chief geologist of the Cleveland Cliffs Iron Company; Stephen Royce, consulting mining geologist representing Pickands Mather and Company; Dean James Fisher, of the Michigan College of Mining and Technology; and Professor N. H. Manderfield, head of the mineral dressing department of the institute.

In charge of all arrangements was Dr. A. K. Snelgrove, formerly of Princeton University and now head of the department of geological engineering at Michigan College.

THE ENGINEERING COLLEGE RESEARCH ASSOCIATION

SEVENTY-THREE engineering colleges from all parts of the country have organized an Engineering College Research Association to cooperate with the war agencies of the Government and with war industry in the prosecution and promotion of research needed for the war effort.

The council of the association, with Dean W. R. Woolrich, of the College of Engineering of the University of Texas, as chairman, held its first meeting in Washington on November 27. The formation of the organization closely follows the establishment by the War Production Board of the Office of Production Research and Development under the direction of Dr. Harvey N. Davis, president of the Stevens Institute of Technology. A close degree of liaison between this office and other governmental and private agencies dealing with wartime research will be maintained by the association in an effort to utilize to the fullest possible degree the vast research facilities of the engineering colleges of the nation.

The association will coordinate the research activities of the engineering college laboratories and personnel for the task of conducting vital studies affecting war materials and production. It will also assist in organizing the research facilities of the engineering colleges in undertaking studies designed to promote post-war reconstruction and economic adjustment through new and improved processes affecting industry, public works, the conservation and development of natural resources, public health and other similar activities. It is further planned that the group will act as a continuing agency for developing and coordinating industrial and scientific research and the furtherance of advanced study in the colleges of

engineering in the United States. It is pointed out that through the cooperation of such a large number of leading engineering schools expensive and wasteful duplication of effort will be avoided, and that a maximum utilization of facilities and personnel and a high degree of coordination will result.

In addition to Dean Woolrich other officers of the association are: Dean Earle B. Norris, Virginia Polytechnic Institute, *First Vice-president;* President C. C. Williams, Lehigh University, *Second Vice-president;* Dean R. L. Spencer, University of Delaware, *Treasurer.* Council members of the group are Dean Ivan C. Crawford, University of Michigan; Dean Thorndike Saville, New York University; Dean Samuel B. Morris, Stanford University; Dean F. M. Dawson, the State University of Iowa; Dean N. A. Christensen, Colorado State College, and Dean G. M. Butler, University of Arizona.

This is the first time that the research departments, institutes and experimental stations of technological institutions have been brought together in an organization of this kind. While most of the members are already associated in other professional and educational groups, they have never joined hands for the express intention of coordinating and stimulating engineering research. It brings together in one group institutions with research facilities valued at many million dollars.

SCIENTIFIC NOTES AND NEWS

ORVILLE WRIGHT has been elected an honorary member of the British Institution of Mechanical Engineers in recognition of "his distinguished contributions to mechanical science." It is said in the citation that "his early pioneer research and eminent scientific attainments have richly endowed the annals of science."

THE twenty-seventh annual dinner of the Institute of Medicine of Chicago was held at the Palmer House on December 2. The dinner was in honor of Dr. Ludvig Hektoen and Dr. James B. Herrick, who have been active members of the Board of Governors since the founding of the institute in 1915. Dr. James P. Simonds spoke on "Ludvig Hektoen: A Study in Changing Scientific Interests," and Dr. J. Christian Bay on "James B. Herrick: Youth in Man Makes History."

DR. BERNARD SACHS, neurologist and founder of the neurological division of Mount Sinai Hospital, past-president of the New York Academy of Medicine, who will be eighty-five years old on January 2, was presented at a special ceremony on November 24 with a volume of 700 pages containing eighty-three original papers on the progress of neurology, compiled in honor of his sixty years of medical practice and research. Dr. Foster Kennedy, chief of the Neurological Service at Bellevue Hospital, presided.

DR. F. W. HODGE was elected president of the Western Museums Conference at the recent Los Angeles meeting.

AT the second annual meeting of the Montana Academy of Sciences, held on October 30 and 31 at Helena, the following were elected to office for the coming year: Rev. B. J. Topel, Carroll College, *President;* Dr. Harold Chatland, Montana State University, *First Vice-president and Editor;* Dr. D. Q. Posin, Montana State School of Mines, *Second Vice-president;* Dr. R. W. Hiatt, Montana State College, *Third Vice-president,* and Professor Melvin S. Morris, Montana State University, *Secretary-Treasurer.* The academy, in the organization of which Dr. Gordon B. Castle, of Montana State University, and Dr. Harlow B. Mills, of Montana State College, took a leading part, was planned in 1940 at a general meeting held in Great Falls.

DR. EDWIN F. GILDEA, associate professor of psychiatry at the School of Medicine of Yale University, has become professor of psychiatry and administrative head of the department of neuropsychiatry at the School of Medicine of Washington University, St. Louis.

DR. HAROLD PHILLIPS HILL, clinical professor of medicine at the School of Medicine of Stanford University, San Francisco, has been made professor emeritus. Dr. Victor E. Hall and Dr. John Field, II, in physiology, and Dr. Charles E. Smith in public health and preventive medicine have been promoted to full professorships.

THE enlargement of a program of research into the causes of cancer has been made possible at the University of Minnesota by a gift of $5,500 a year for five years from the Citizens Aid Society of Minneapolis to support what will be known as the George Chase Christian professorship in cancer research. Dr. John J. Bittner, now associate director and vice-president of the board of directors of the Roscoe B. Jackson Memorial Laboratory at Bar Harbor, Maine, has been appointed the first incumbent of the chair. Associated with Dr. Bittner, who will study the cancer problem as a geneticist, will be Dr. Maurice B. Visscher in physiology and Dr. Robert G. Green in bacteriology.

F. W. PARKER, of E. I. du Pont de Nemours and Company, Inc., has for the duration of the war become chief of the Division of Fertilizer Research of the Bureau of Plant Industry. He succeeds R. M. Salter, who has been made chief of the bureau.

DR. D. P. MORGAN, chemical consultant for Scudder, Stevens and Clark of New York, has been appointed director of the chemicals division of the War Production Board.

DR. WALLACE H. WULFECK, formerly associate director of marketing research at the Psychological Corporation of New York, has been appointed director of research for the Federal Advertising Agency of New York.

DR. WILLIAM T. ANDERSON, JR., for nearly twenty years director of the radiation research laboratory of the Hanovia Chemical and Manufacturing Company, has been granted leave of absence to enable him to accept a commission as a lieutenant in the Naval Reserves.

DR. S. A. SALETORE has been appointed director of the Laxmi Narayan Institute of Technology at Nagpur, India. Dr. A. Nagaraja Rao, of the Imperial Institute of Sugar Technology, Cawnpore, has been appointed professor of applied physical chemistry in the same institute.

LIEUTENANT COLONEL G. R. ENSMINGER, of the Safety and Security Branch of the U. S. War Department, has been appointed a member of the Sectional Committee of the American Standards Association on Allowable Concentrations of Toxic Dusts and Gases. The committee will determine and promulgate the allowable concentration limits of harmful gases, vapors, fumes, dusts and mists in the atmosphere of working places, from the viewpoint of the prevention of occupational disease.

HENRY ROY DEAN, F.R.S., professor of pathology at the University of Cambridge, has been elected representative of the university on the General Medical Council for the next five years.

THE first annual Robert J. Terry Lecture was delivered before the St. Louis Medical Society on December 1 by Dr. Stuart Mudd, Philadelphia. He spoke on the "Morphology of Pathogenic Bacteria and Viruses as shown by the Electron Microscope, with Some Practical Implications." The lecture was established through a bequest of $5,000 in the will of Dr. William T. Coughlin, who died in May, 1940.

DR. IRVINE McQUARRIE, professor of pediatrics at the Medical School of the University of Minnesota, delivered on November 3 and 4 addresses of the Porter Lectureship in Medicine of the School of Medicine of the University of Kansas. His subjects were "Experiments of Nature and the Advancement of Medical Knowledge," "Medical Experiences in Besieged China" and "Diseases of Adrenal Glands in Children."

DR. A. F. BLAKESLEE, formerly director of the Department of Genetics, Carnegie Institution of Washington at Cold Spring Harbor, now William Allan Neilson professor at Smith College, gave two lectures at Toronto on November 21, one in the series of Saturday evening public lectures of the Royal Canadian Institute on "Controlled Development of Plants" and the other to members and friends of the Botanical Club of the University of Toronto on "Segmental Interchange in the Evolution of Chromosomes."

DR. A. J. CARLSON, of the University of Chicago, spoke before the Syracuse Chapter of Sigma Xi on December 2. His address was entitled "Some Unknowns in the Physiological Pathology of Aging."

DR. ALEXANDER SILVERMAN, head of the department of chemistry of the University of Pittsburgh, will make an address at the Franklin Institute on December 16. He will speak on "Glass and the War."

DR. E. D. MERRILL, administrator of botanical collections at Harvard University and director of the Arnold Arboretum, delivered from November 12 to 18 a series of lectures at Cornell University on the origin of cultivated plants, under the auspices of the Joseph H. Schiff Foundation. In connection with the three lectures in this series he also conducted a seminar on problems of botanical bibliography and one on the botanical work of C. S. Rafinesque.

DR. COLIN M. MACLEOD, of New York University, and Dr. Alphonse R. Dochez, of Columbia University, will participate on the evening of December 7 in a discussion on "The Atypical ('Virus') Pneumonias" at the College of Physicians and Surgeons, New York. This is the second program arranged by the New York Bacteriologists' War Research Projects Group to review bacteriological problems of importance for the war in order to formulate research projects to be undertaken by members of the group.

WORKERS with the electron supermicroscope held a symposium in Chicago on November 27 under the leadership of Professor G. L. Clark, of the University of Illinois. The symposium was planned as part of the National Chemical Exposition. In addition to representatives of the laboratories already having electron microscopes, many government and industrial laboratories sent representatives. The symposium was the first opportunity that workers in this

field have had to exchange ideas and information about techniques and problems. It may lead to a permanent organization. Among the subjects discussed were problems of operation, of mounting specimens, enlarging electron micrographs, interpreting the micrographs and of using the electron microscope for electron diffraction and in the examination of bacteria, cells, rubber, synthetic rubber, cellulose, colloids, powders, clays, ores, smokes, oils, etc. The latest types of electron microscopes were exhibited. Dr. V. K. Zworykin, associate director of RCA Research Laboratories, gave a lecture on the relation of the electron microscope to chemical research.

THE Committee on Meteorological Education of the American Meteorological Society, Professor A. F. Spilhaus, chairman, recently organized a panel of readers from members of the society who are willing to review manuscripts of meteorological books for publishers who may wish to use this service of the society. The panel consists of a number of professional meteorologists, each an expert in one or more phases of the field. Publishers wishing to avail themselves of the services of the panel are asked to address inquiries to the chairman of the Committee on Meteorological Education, stating the type of manuscript to be reviewed. The committee will suggest the individual or individuals on the panel who would be best suited to make the review. In Canada this procedure will be cleared through Dr. Andrew Thomson, the Canadian member of the committee.

THE new plant for the manufacture of electronic tubes of the National Union Radio Corporation at Lansdale, Pa., was formally opened recently with ceremonies in which Army and Navy officers participated. The National Union Company was welcomed to Lansdale by Floyd B. Kulp, president of the borough council, and S. W. Muldowny responded for the company. The plant, representing the most advanced design and construction, is 40,000 square feet in area. Included in it are offices, laboratories and complete manufacturing facilities. All activities are carried out on a single level.

As of November 28, 397 staff members of the University of Illinois had entered the military and navy armed services, while 31 others had been granted leaves for the war service other than in the armed forces. These include members of the university at Urbana and of the Colleges of Medicine, Dentistry and Pharmacy at Chicago.

AT the request of the National Research Council, Washington, D. C., the department of botany of Field Museum, Chicago, is preparing manuals of plants of the tropics which are likely to be of special interest or concern to soldiers, sailors and marines at posts in Latin America. The manuals describe and figure plants which are poisonous or otherwise noxious, as well as those which are valuable as sources of food for enlarging the diet or as emergency rations. The manual on the plants of the Guianas and Brazil, of which a section on poisonous plants has already been printed, is being prepared by Dr. B. E. Dahlgren, chief curator of the department. The manual of plants of Central America is in the hands of Paul C. Standley, curator of the herbarium.

THE Yale chapter of the Society of the Sigma Xi has announced the election of 95 new members and associates who come from 20 states and Argentina and Canada. Of those chosen, 12 are faculty members and research fellows, 44 are graduate students, and 39 are undergraduates. Six undergraduates in Yale College, the School of Engineering and the Sheffield Scientific School received the extraordinary honor of election in their junior year.

DISCUSSION

THE OLD STARFISH-CLAM QUESTION

THE question as to how a starfish can open a clam so as to insert the starfish's stomach between the valves and thus digest the clam has been discussed for generations.

Any one who has tried to pry open the valves of a clam or oyster will feel sure that no starfish could force the valves apart by any sudden pull. During some recent experiments the writer tested the force necessary to open average-sized oysters and little-neck clams (*Venus*) by inserting a steel hook in a notch ground in each valve and then pulling with a large spring scale. One oyster, after having been subjected to a pull of 1,500 grams for 40 hours required 22 pounds pull with the scale before the adductor muscle was torn apart. Another oyster under similar conditions required a pull of 30 pounds. Several clams subjected to a pull of from 23 to 26 pounds were still intact when the shells broke. It would seem, therefore, that instead of being able to resist a sudden pull of 4,000 grams, as has been stated, these bivalves may withstand a pull of from 10,000 to 14,000 grams, or more. It is to be noted, also, that the hooks used in the above experiments were attached to the middle of the margin of the shells, where the greatest leverage was exerted, while only a relatively small number of

tubefeet could find attachment along this ventral margin, and many attached near the hinge would have practically no leverage.

Many of the text-books of zoology discuss this subject and several of them quote from Shipley and MacBride, as in the following, from Newman's "Outlines of General Zoology," 1936: "'It was long a puzzle how the starfish succeeded in forcing its victim to relax its muscles and allow its valves to open. It was supposed that the stomach secreted a paralyzing poison, but it has been conclusively known that this is not the case, but that the starfish drags the valves of its victim apart by main force, often actually breaking the adductor muscles. The pull exercised by the suckers is not nearly strong enough to open the valves at once, but the starfish has staying power and eventually the muscle is slowly forced open.' The secret of the unusual endurance of the starfish is that its tubefeet work in relays, some resting while others work." It will be noted that Newman ascribes the supposed great endurance of the starfish to the working in relays of the tubefeet.

In Bigelow's "Applied Biology," 1911, is given another theory which seems very reasonable. He says: "A starfish fastens its suckers on an oyster, and then the stomach covers the edge of the oyster's shell with the result that the currents of water are stopped and the animal within the shell is killed by suffocation. The shell then gaps open, the starfish's stomach pours in its secretion, the tissues of the oyster are dissolved (digested) while in its own shell, . . ."

How completely the stomach of the starfish covers the edges of the bivalve shells the writer has never noticed; but it seems likely that, at least in the case of those having well-developed siphons, it would only be necessary to cover the region where the siphons are located.

In the fifth edition (1942) of his "College Zoology" Hegner is non-committal, saying simply: "Starfish are often destructive in oyster beds since they succeed in pulling open the shells and devouring large numbers of these bivalves."

In a personal letter Thurlow C. Nelson, an oyster specialist, says: "I have always been most skeptical of the current idea that a starfish opens an oyster by main force." He says, "What I said was that a starfish can not exhaust an oyster owing to the fact that the muscle when closed automatically locks." He refers to the discussion of this locking mechanism in Bayliss's "Principles of General Physiology."

Some three dozen clams (*Venus*) and oysters were tested, by the writer, to get some idea as to their endurance. The bivalves were bought at stores in Morgantown and had all doubtless been out of the sea for considerable but varying lengths of time. The artificial sea water, mostly simply 3.5 per cent. NaCl, was usually at the laboratory temperature from 20° to 27° C. It is likely that under these rather unfavorable conditions the endurance of the molluscs was somewhat reduced. A small notch was ground, on a carborundum wheel, in the ventral edges of the valves, just large enough to insert two small steel hooks. One hook was fixed, the other was attached to a cord that ran over a pulley and had an easily changeable weight attached. The animal was suspended, ventral side up, in the salt water. The extreme ventral edges of the valves were just above the surface of the water. As the valves were forced open the gape was measured, at intervals, in millimeters. There was not much variation in the sizes of the specimens used. A considerable variation was noted in the endurance of both oysters and clams, possibly due to the differences in their individual vitality, just as some will live out of water much longer than others. For example, one clam, whose valves did not seem tightly closed, was opened and its muscles torn apart in 45 minutes by a pull of 3,700 grams; while another clam endured the same traction for 48 hours without the muscles tearing, though the valves gaped 26 mm.

Various weights from 900 to 4,000 grams were used. One oyster with a pull of 1,500 grams, which is more than the estimated strength of the starfish (however, this strength may have been estimated) at the end of 5 days had a gape of only 12 mm, wide enough, perhaps, for the insertion of a starfish stomach. Another oyster, under 1,500 grams traction, had a gape of 11 mm and required a pull, with the spring scale, of 22 pounds (more than 10,000 grams) before it could be torn apart, at the end of 48 hours. One clam, under a traction of 1,500 grams, remained tightly closed for about 45 hours, and at the end of 5 days had a gape of only ½ mm; at the end of 8 days the gape was 7 mm (rather narrow for insertion of a stomach); on the ninth day the muscles were torn apart.

In some cases the valves opened for a millimeter or two within a few minutes, but when the valves were tapped with a pencil they snapped together instantly. In general this more-or-less sudden closure of the valves when tapped occurred even after several hours or even days.

This fairly early opening to a very slight degree might lend support to the theory that the starfish secretes over its victim a paralyzing fluid, since the fluid could pass through a narrow opening that would be quite impassable for the stomach of the starfish. Of course the starfish may have unbelievable endurance, especially if it can rest its tubefeet by using them in alternate groups, as suggested above by Newman.

It would be interesting to test the strength and endurance of perfectly fresh specimens under normal, sea conditions.

A. M. Reese

West Virginia University

THE FIRST FREE-LIVING FRESHWATER JELLYFISH FROM SOUTH AMERICA

This past March, Mr. German Frick, an engineer residing in Santiago, Chile, was much surprised to see jellyfish moving about in a small body of fresh water in Tranque Marga-Marga, near Quilpué (Province of Valparaíso), 40 kilometers from the sea. Seeking more information about them, he took several of them to the senior author who, in turn, appreciating the uniqueness of the discovery, forwarded the specimens to the U. S. National Museum, along with a very realistic, original sketch of the animals.

A comparison with preserved material in Washington readily permits the identification of both sketch and specimens with the well-known widely distributed *Craspedacusta sowerbii* (Lankester). This species has heretofore been reported from Europe (Austria, Czecho-Slovakia, England, France, Germany, Holland, Poland and Russia), Asia (China and Japan), the Hawaiian Islands, twenty of the United States of North America, Panama (in the Canal Zone near Barro Colorado Island) and from an aquarium only at Porto Alegre, Brazil.[1] The present record, however, is the first for the free-living freshwater medusae in South America.

The medusae varied from 5 to 10 mm in diameter. They were much disintegrated after their long voyage to North America. There were at least five series (sizes) of tentacles, and probably seven in the largest specimen; the smallest specimen had only four series.

Carlos E. Porter

Santiago, Chile

Waldo L. Schmitt

Washington, D. C.

DEFORMATION OF ROCK STRATA BY EXPLOSIONS

A recent note by Boon and Albritton[1] mentions the Sierra Madera Dome of western Texas as an example of a structure which might possibly have been formed by explosion from a meteoric impact.

It happens that in the course of a routine gravity survey in Pecos County, Texas, stations were made on and around Sierra Madera. The results of this work have been indicated in another connection in a paper by Hammer.[2] The gravity work indicates a positive gravity anomaly with a relief of about 3.5 mg.[3] Presumably if the geologic structure were caused by a meteoric impact, the only explanation for the positive gravity anomaly would be excess mass brought in by the meteor. The form and width of the gravity anomaly can be accounted for by a concentrated (*i.e.,* spherical) mass with its center at a depth of the order of 8500′ and with a total excess mass of the order of 4×10^{15} grams. If it were assumed that this were a sphere of meteoric iron, the required diameter would be about 3000′. The gravity anomaly is quite well centered over the topographic feature and therefore the excess mass must be substantially vertically below the surface geologic feature.

The depth and mass required to explain the gravity anomaly both seem much too large to be associated with a meteorite. Therefore, the geophysical contribution makes it seem much more probable that this feature is caused by igneous intrusion or some other more ordinary geologic processes rather than being the result of a meteoric explosion.

L. L. Nettleton

Gulf Research & Development Co.,
Pittsburgh, Pa.

SEGREGATION OF TYPE SPECIMENS

The result of inquiries made by a committee of the Systematic Section of the Botanical Society of America and the American Society of Plant Taxonomists shows that of about 76 North American herbaria known to contain type specimens, 23 keep their types segregated from the main collections. In 8 of these, including the U. S. National Herbarium, Gray Herbarium, New York Botanical Garden, Philadelphia Academy, Rocky Mountain Herbarium and the herbaria of the Universities of Pennsylvania, North Carolina and Arizona, the segregation is in progress, but not complete. The Los Angeles Museum has its types stored in a vault in the interior of the country for the duration of the war. The U. S. National Herbarium is preparing to move its type collection to a safer location during the war, but this has not yet been accomplished. The New York Botanical Garden is in the midst of the process of segregation, and as the types are removed from the main collection, they are being sent to an institution in a safer locality.

About 20 of the collections containing types are housed in buildings which are not fireproof. This includes such important herbaria as the U. S. National Herbarium, the Bailey Hortorium and the Arthur Herbarium of rust fungi at Purdue.

What the above means is that in at least 20 American herbaria types are exposed to the risk of fire,

[1] Rudolf Gliesch, *Egatea,* 15: 145–148, figs. 1–11. Porto Alegre, Rio Grande do Sul, 1930. Gives notes on occurrence of both polyps and medusae in an aquarium at Porto Alegre; *Microhydra* is synonymous with *Craspedacusta.*

[1] J. D. Boon and C. C. Albritton, Jr., Science, n.s., 96: 2496, 402, October 30, 1942.

[2] Sigmund Hammer, "Terrain Corrections for Gravimeter Stations," *Geophysics,* 4: 3, 187, July, 1939.

[3] 1 mg. = 1 milligal = .001 cm/sec.^{2}

and in at least 53 they are handled every time the covers of the species they represent are taken out, even for routine determination, filing, etc. Over a period of years this handling inevitably results in breakage.

Considering that types are irreplaceable and that they are one of the basic assets of the science of botany, the complacency of American botanists is indeed remarkable. That many European scientific institutions have been severely damaged by bombs is an indisputable fact. Yet apparently only three institutions in the United States are taking steps during the war to get their types out of bombing range. This is almost beyond belief, considering the magnitude of steps taken in other aspects of civilian defense throughout the nation.

F. R. FOSBERG

FALLS CHURCH, VA.

QUOTATIONS

THE PITTSBURGH MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE[1]

TO THE MEMBERS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE:

WHEN the American Association for the Advancement of Science and all similar societies planned their winter meetings, the present situation could not have been foreseen. We had not even entered the war, and did not dream of a congestion of transportation such as now exists. When the present situation had developed, it was (in the opinion of a majority of the committee having power) too late to postpone our meeting.

Transportation is now so greatly overtaxed that necessaries of life can barely be carried; the railways should be spared every extra burden. Great simultaneous pilgrimages on important trunk lines are especially to be avoided, since they demand extra trains, needing extra locomotives and coal, and causing much confusion. Therefore, in my opinion it behooves every patriotic and unselfish member to consider very seriously whether he can really serve his country by attending the meeting, or whether he can not better serve in this fateful time by staying at home, especially during a period of highly congested travel, when many of our soldiers may wish to take leave of their families before departing for the front. I believe that only those persons bringing really important contributions to the problems of the war should attend such meetings now. All others, in my opinion, should conserve their money for Liberty bonds and for those in distress, and should save their strength for action in this time of extraordinary crisis. For these reasons, with great regret, I have decided not to attend the meeting at Pittsburgh.

So far as I have been able to ascertain, all the responsible authorities at Washington concerned with transportation agree with me as to the importance of avoiding unnecessary journeys in such a crisis.

The very great usefulness of the American Association for the Advancement of Science is not dependent upon the unbroken continuity of its social meetings.

Science is incalculably important, indeed indispensable, in this world-wide cataclysm. The excellent work of the association in the past is now bearing fruit; but this moment demands action rather than general discussion. We must devote all our energies to winning the war. Let us all make every endeavor to apply our knowledge and strength in our country's noble cause.

THEODORE W. RICHARDS,
President of the Association

CAMBRIDGE, MASS.,
DECEMBER 15, 1917.

[1] SCIENCE, December 28, 1917, p. 638.

SCIENTIFIC BOOKS

CHEMISTRY

The Chemistry of Organic Medicinal Products. By GLENN L. JENKINS and WALTER H. HARTUNG. xii + 457 pp. Planographed by John S. Swift Co., Inc., St. Louis. 1941. $6\frac{1}{2} \times 9\frac{1}{2}$ in. $3.00. Bound in stiff paper.

THIS book, by the dean of the Purdue University School of Pharmacy and the professor of pharmaceutical chemistry of the School of Pharmacy of the University of Maryland, has been written primarily as a text-book for those advanced students in pharmacy who have had the requisite training in chemistry, particularly organic chemistry, but should prove useful also to the organic chemist interested in this field and to the medical practitioner who wishes to know something more about the chemistry of the drugs he is prescribing.

The classification of the subject-matter is strictly chemical, although not following entirely the customary division into the major groups of I. Acyclic (or Aliphatic), II. Isocyclic, and III. Heterocyclic.

Acyclic and isocyclic compounds are discussed together in chapters whose headings are determined by the particular functional groups present. Thus, the chapter entitled "Hydroxyl Derivatives of Hydrocarbons" deals with Alcohols, Polyhydroxy Alcohols, Unsaturated Alcohols, Cyclic Alcohols, Sterols, Aromatic Alcohols, Phenols and Halogenated Hydroxyl Compounds, in that order. After considering the acyclic and isocyclic compounds in such chapters, there follow two on Heterocyclic Compounds and a final one on Stereoisomerism. Before proceeding to a consideration of the separate chapters, a bibliography of standard reference works likely to be helpful to the reader, and occupying five pages, is inserted; in addition to which numerous references are given throughout the text.

Although, as already noted, the classification varies somewhat from the conventional, the volume constitutes an abbreviated text-book of organic chemistry, in which the usual sections on isomerism, nomenclature, preparation, physical and chemical properties, are supplemented by paragraphs or sections on physiological activity and, where justified, on the apparent connection between such activity and chemical structure. Pharmacological and therapeutic information is presented concisely without attempting to record details more appropriate for treatises in these special fields. Uses and modes of administration are also recorded, as well as the accepted trade names for the more important drugs.

The ancient materia medica, consisting largely or wholly of natural products of complex and variable composition, are rapidly being displaced by the products of the organic chemists' laboratory, and ere long most of them will be as extinct as the dodo, giving place to such triumphs of the laboratory as arsphenamine, the hormones, vitamins and the sulfanilamides. The book is profusely illustrated with structural formulas, tables, charts and diagrams, and is provided with an excellent index. A laboratory manual to accompany the text has been prepared by Drs. Hartung, Summerford and Dunker.

Chemistry of Insecticides and Fungicides. By DONALD E. H. FREAR. viii + 300 pp. $6\frac{1}{4} \times 9\frac{1}{4}$ in. New York: D. Van Nostrand Company, Inc. April, 1942. $4.00.

IN these days of global warfare, when every one is praying for an early cessation of the conflict, we can not overlook the fact that we are engaged also in another kind of struggle, in which our enemies are not fellow humans but other living organisms, and that this war has been going on since the dawn of man's history and will probably continue until its close. Little is to be feared from the larger animals, for they all recognize man as their master and their fate as in his hands; but it is in the smaller animals and the lower forms of life that man finds his deadliest and most implacable enemies. These attack him either directly, by causing various diseases, or indirectly by destroying his means of subsistence. One of the important hostile armies in the latter category is that of the plant pests, and the present book discusses the chemistry of those compounds which have been found useful as insecticides or fungicides, in order that the campaign against these enemies may be conducted more intelligently and more successfully.

The text is based upon a graduate lecture course organized and given by the author at the Pennsylvania State College, and each chapter concludes with an excellent bibliography.

After the Introduction, the separate chapters are grouped under five general headings as follows: *Part I. Stomach Poisons or Protective Insecticides.* Arsenicals, Lead Arsenate, Fluorine Compounds and Miscellaneous Stomach Poisons; *Part II. Contact Poisons or Eradicant Insecticides.* Nicotine and Pyrethrum, Rotenone and Miscellaneous Contact Poisons, Sulfur and Inorganic Sulfur Compounds, Oils and Fumigants; *Part III. Fungicides.* Copper Compounds, Mercury Compounds and Miscellaneous Fungicides. *Part IV. Spray Supplements and Residue Removal.* Wetting, Spreading and Emulsifying Agents, and Spray Residue Removal; *Part V. Analytical Methods.* Macro Methods and Micro Methods.

As can be seen from these titles, the book should be useful to inorganic, organic and bio-chemists, as well as to plant pathologists and economic entomologists, and it is cordially commended to them. Paper, type, presswork and binding are admirable; the proofreading has been done carefully; and some interesting illustrations of natural products are included.

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A FRESHMAN TEXT IN MATHEMATICS

Basic College Mathematics, A General Introduction. By CARL WALLACE MUNSHOWER and JAMES FLETCHER WARDWELL. xiii + 612 pp. New York: Henry Holt and Company. 1942.

THIS text is designed to cover in one year essential selected topics in algebra, trigonometry, analytic geometry and calculus, so as to provide a profitable terminal survey for students taking but one college course in mathematics, and also an introduction for those who prepare for further mathematical work. The subject-matter organization is intended to furnish a psychologically acceptable unified course with the rate concept introduced in the first chapter. So much material has been provided in these twenty-one

chapters that many teachers might desire to omit some entire chapters. The planning of these separate chapters is expected to afford wide freedom of choice for such omission, or for rearrangement, without interfering with the student's progress. The chief claim to novelty lies in the wide variety of fields from which verbal problems have been gleaned. The text has been prepared with somewhat more than average care, although the reviewer notes several definitions and formal explanations which seem not above criticism. Answers are provided for odd-numbered problems. Approximately the last hundred pages are devoted to numerical tables, reference formulas and (somewhat incomplete) index.

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SPECIAL ARTICLES

AN INFECTIOUS AGENT FROM CASES OF ATYPICAL PNEUMONIA APPARENTLY TRANSMISSIBLE TO COTTON RATS[1]

RECENTLY a primary atypical pneumonia of unknown etiology has been a rather common disease.[2] Observations made in this laboratory since March, 1941, suggest that in some cases of this disease an infectious agent is transmissible to cotton rats (*Sigmodon hispidus*) and produces pulmonary consolidation after the first intranasal inoculation of sputum or lung under ether anesthesia. Both the eastern cotton rat (subspecies *hispidus*) and the western cotton rat (subspecies *eremicus*) are susceptible.

The results with material from a total of 78 cases of atypical pneumonia are summarized in Table 1.

TABLE 1

RESULTS OF INOCULATING COTTON RATS WITH SPUTUM OR LUNG TISSUE FROM CASES OF ATYPICAL PNEUMONIA

	Days after onset	Number of specimens causing lung lesions	Number of specimens causing no lung lesions
Sputum	5 or less	8	11
Sputum	6 to 9	4	15
Sputum	10 or more	1	19
Sputum	unknown	2	9
Lung	....	2	7
Total		17	61

Similar material gave negative results in mice, ferrets, hamsters and other animals. Sputums taken early in the disease often produced lung lesions rather consistently when several cotton rats were inoculated with the same specimen. Fully grown or old animals were more susceptible than those 3 to 7 weeks of age. Of the total of 131 cotton rats receiving material from cases of atypical pneumonia 35 developed lung lesions. Thirty-four control cotton rats inoculated intranasally with throat washings from cases of influenza or with heated sputum, horse serum broth or other materials did not develop significant lung lesions. All animals were sacrificed 7 days after inoculation. Only one out of more than 50 cotton rats used in experiments not connected with atypical pneumonia has shown lung lesions at autopsy.

By serial intranasal passage of lung suspensions from animals which had lesions on the first passage, strains of an infectious agent from 6 cases of atypical pneumonia were adapted to cotton rats. In 2 cases this adaptation was repeated, starting from the original sputum, but using cotton rats of a different subspecies. After 4 to 6 passages the adapted strains produced gross evidence of lung involvement in over 90 per cent. of the animals inoculated, but seldom caused death. With sputum from 11 cases lung lesions were produced on first inoculation, but no adaptation by serial passage was obtained. When the lungs of normal cotton rats or of animals which developed no lesions after inoculation of sputum were passed serially, the results were uniformly negative.

The lung lesions were patchy red-gray with maximum intensity at 6 to 8 days. Microscopic examination of sections of lungs showed an infiltration of the septa with polymorphonuclear leucocytes and mononuclear cells and hyperplasia of the alveolar epithelium. No inclusion bodies, elementary bodies, rickettsiae or visible microorganisms were seen in sections or in impression smears stained by the methods of Gram, Giemsa or Macchiavello. Cultures on blood agar and horse serum broth were negative. In 2 out of 6 filtration experiments using Berkefeld N candles passage of the agent was demonstrated.

Strains which had been adapted to cotton rats produced lung lesions after intranasal inoculation of Syrian hamsters (*Cricetus auratus*), but caused no detectable disease in mice, rabbits or guinea pigs. Animals which had recovered (in about 14 days) from intranasal inoculation of the pneumonia agent were solidly immune to reinoculation by the same route. Infected cotton rat lung produced neither illness nor

[1] The studies and observations on which this paper is based were conducted with the support and under the auspices of the International Health Division of The Rockefeller Foundation in cooperation with the California State Department of Public Health. Most of the material for laboratory studies was obtained through the courtesy of physicians at the Medical Center and the Cowell Memorial Hospital of the University of California.

[2] For literature review and references see J. H. Dingle and M. Finland, *New England Journal of Medicine*, 227: 378, 1942.

immunity when inoculated intracerebrally or intraperitoneally into cotton rats.

Neutralization tests with serum-virus mixtures incubated for 1 hour at 37° C. and then kept in the icebox overnight were performed by inoculating cotton rats and hamsters intranasally. Sera from hyperimmunized cotton rats, hamsters and rabbits gave definite neutralization of the agent. Partial or irregular neutralization was observed with sera of human beings convalescent from atypical pneumonia, with sera of cotton rats inoculated once only or of guinea pigs inoculated repeatedly with cotton-rat adapted strains, and with sera from rabbits immunized with human lung infectious for cotton rats.

By cross-inoculation and neutralization tests antigenic relationships between 6 established strains were demonstrated. Cotton rats immunized by two successive intranasal inoculations with adapted strains were solidly immune to reinoculation with a specimen of infectious human lung which produced marked lesions in the controls. Cotton rats immunized with human material were partially resistant when tested with adapted strains.

During the course of serial passages from cotton rats which developed lung lesions on the first inoculation, two strains not antigenically related to those just described were obtained. These two "aberrant" strains may have been carried by the cotton rats and had apparently replaced the agent present in the first passages.

The appearance of non-bacterial lung lesions in cotton rats after inoculation of material from cases of atypical pneumonia suggests that a virus-like agent was transmitted and established by serial passage. The strains adapted to cotton rats were related to the agent in human material by cross-immunity tests. This agent, which is presumably a filterable virus, differs from the psittacosis-like virus previously described[3] and also from other known viruses which can infect cotton rats by the intranasal route. At present the evidence for the causal relation of this agent to the most common form of atypical pneumonia must be considered incomplete because of irregularities in the neutralization tests, particularly those with human serum. Further investigations on the influence of the amount of the infecting dose on the neutralization test are in progress.

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[3] M. D. Eaton, M. D. Beck and H. E. Pearson, *Jour. Exp. Med.*, 73: 641, 1941.

DESTRUCTION OF HYPERTENSIN AND PEPSITENSIN BY AN AMINOPEPTIDASE OBTAINED FROM YEAST

THE vasoconstrictor properties of hypertensin (angiotonin) and pepsitensin—a substance formed by the digestion of proteins with pepsin—can be entirely destroyed by an aminopeptidase (a.p.) enzyme obtained from yeast and purified by the Johnson method.[1]

These two hypertensive substances incubated with that enzyme at 38° and neutral pH. lose their vasoconstrictor properties in a few minutes.

Approximately 0.01 cc of the final purified solution obtained from 2 kg of compressed yeast destroys them after 5- to 10-minutes incubation (2 or 3 units of hypertensin or pepsitensin). The degree of destruction of these two products under the influence of the enzyme was controlled by the method previously described, using the Loewen Trendelenburg test and the arterial pressure of the cat.[2]

The mixture of hypertensin or pepsitensin with the enzyme was injected after different periods of incubation and the vasoconstrictor or pressor effects obtained were compared with those produced by an equal dose of substrate and the enzyme mixed immediately before injecting. Sometimes as a means of controlling the results, a mixture of enzyme was used, incubated for the same length of time, and previously inactivated by boiling with the vasoconstrictor substance (Fig. 1).

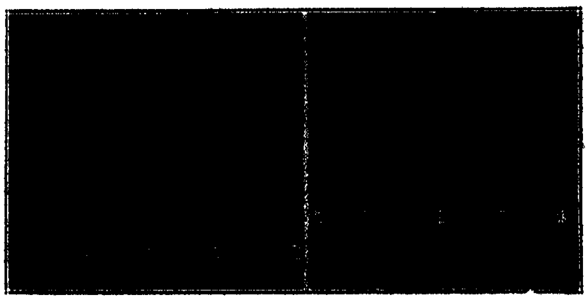

FIG. 1. Arterial pressure increase produced by: 1: 0.4 cc hypertensin; 2,3,4,5,6: 0.5 cc hypertensin incubated 5′ with 0.0025, 0.005, 0.01, 0.02 and 0.03 cc of a.p. 676 F respectively 7: 0.5 cc water with 0.08 cc a.p. 672 F 8,9,10,11: 0.5 hypertensin.

Titration of polypeptid nitrogen during incubation showed a progressive and considerable diminution. A similar result was obtained when renal hypertensinase acted upon hypertensin or pepsitensin.

The hydrolytic activity of yeast enzyme on synthetic substances allows one to classify this enzyme as a.p.[3] Hypertensinase extracts of pig kidneys, purified by

[1] M. J. Johnson, *Jour. Biol. Chem*, 127: 575, 1941.
[2] H. Croxatto and R. Croxatto, SCIENCE, 42: 101, 1942.
[3] J. S. Fruton, G. W. Irving, Jr. and M. Bergmann, *Jour. Biol. Chem.*, 141: 763, 1941.

acetone precipitation, and yeast enzymes hydrolyze l-leucylglycine. Hypertensinase and a.p. differ in their action on dl-methyl leucyldiglycine in that the former hydrolyze this polypeptide, while a.p. has no action. This effect may be due to the co-existence of other enzymes contained in the kidney extract, among others renin, which could not be completely separated (Table 1)[4].

TABLE 1

HYDROLYTIC ACTION OF a.p. OF YEAST AND OF HYPERTENSINASE ON SYNTHETIC SUBSTRATES

Enzyme	Undiluted enzyme cc	Time of incubation minutes	Hydrolysis, per cent.	
			dl leucyl-glycine	dl M leucyl-diglycine
a.p. of yeast				
656 I	0.3	30	100	0
619 I	0.1	30	100	0
672 E	0.01	30	100	0
672 F	0.01	30	100	0
672 F	0.002	30	67	0
672 F	0.001	30	33	0
Hypertensinase				
655 II	0.1	180	100	33
655 II	0.1	30	100	18
655 I	0.1	30	100	38
655 I*	0.01	30	30	16
655 II	0.01	30	90	41
655 II	0.01	30	90	=
655 II†	0.01	30	0	=
655 II	0.03	30	100	31
655 II	0.02	30	=	=
655 II	0.02	30	=	=
655 II	0.10	30	=	=
655 II	0.03	30	=	=

* *655 I is a less concentrated product than 655 II.*

† The enzyme was previously boiled. 100 per cent. means the total hydrolysis of a peptidic bond. 619 I contains more *than 1,000 U. per gr of N.* 655 II contains 425 U. per gr of N. 672 F contains 3,000 U. per gr of N. (Johnson) (1). a.p. hydrolyzes 100 per cent. leucyldiglycine. Chloracetyl-*tyrosine and carbobenzoxyglycyl-l-sarcosine are not hydrolyzed* by 655 II.

Moreover the a.p. acts like hypertensinase extracts, whether aerobically or anaerobically; it does not destroy tyramine and its effects on adrenalin are slight or nil.

The destruction of hypertensin and pepsitensin by a.p. establishes a similarity between both vasoconstrictor substrates which is added to those already described.[5] Their polypeptid nature is confirmed and the supposition that these vasoconstrictor substances possess a free NH_2 radical is strengthened. Hypertensinase activity of renal extracts may also be attributed to the existence of a.p. enzyme contained in kidney tissue.

The fact that renin acts as a hydrolytic enzyme of proteinase character (like pepsin)[6] places the cathepsins in a very important position in the problem of experimental hypertension.

Conclusions: An a.p. enzyme separated from yeast inactivates both hypertensin and pepsitensin by a process of hydrolytic destruction. Purified hypertensinase containing renal extracts show a.p. activity.

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[4] Our sincerest thanks to Dr. M. J. Johnson and Dr. M. Bergmann for their kindness in offering the polypeptides used in this paper.

[5] H. Croxatto and R. Croxatto, *Soc. Argent. Biol.*, 17: 439, 1941.

[6] R. Croxatto, H. Croxatto and J. Sorolla, *Rev. de Med. y Aliment. Chile*, 5: 135, 1942.

THE OCCURRENCE OF INTRAVASCULAR AGGLUTINATIONS IN AVIAN MALARIA[1]

INTRAVASCULAR agglutinations or clumps have been described by Knisely and co-workers as occurring in experimental monkey malaria and in various clinical conditions in man. The development of the Knisely quartz rod micro-illuminator has for the first time made possible an adequate study of histophysiology and histopathology of the circulation.

Using a quartz rod micro-illuminator the pathological changes of the circulation were studied in canaries infected with *Plasmodium cathemerium.*[2] The circulation was studied in eight infected and two normal canaries by placing the tip of the rod beneath the dorsal surface of the wing web. The canary was held in place with a specially designed holder which allowed exposure of a wing web ventral side up. A drop of mineral oil placed on the epithelium of the web facilitated visualization of the circulation at 96 × magnification.

All experimentally infected birds developed extensive infestations with parasite counts up to 67 per cent. and all but one died. As the parasite count began to rise progressive pathological changes were noted in the peripheral circulatory tree.

The initial changes were characterized by a loss of "streamlining" of flow, a slowing of the flow rates as indicated by a change in the contour of the parabolic fronts and transient stickings of white blood cells to the endothelial lining of the veinules. These changes were soon followed by evidences of early tissue damage such as plasma leaking with a spreading and rounding of fat cells due to an increase in interstitial fluid. The white cells became plastered to the endothelium in ever-increasing numbers and stuck with increasing cohesiveness as the infection progressed.

These initial changes, together with an increasing

[1] This is a preliminary report of observations in avian malaria supported by the Tennessee Valley Authority malarial research program at the University of Tennessee School of Medicine. The author wishes to acknowledge the courteous suggestions and counsel extended to him by Dr. Melvin H. Knisely, of the Department of Anatomy, University of Chicago.

[2] The canaries were given a standardized infection through the courtesy of Dr. Redginald Hewitt, malariologist for the Tennessee Valley Authority.

parasitization, soon led to the development of more profound intravascular pathology, namely, the formation of sticky masses or clumps of red cells. These clumps or agglutinations were seen first only in the venous stream, were small (three to four red cells) and possessed but little intrinsic cohesiveness. As these clumps flowed into larger veins the shearing forces to which they were exposed broke them up. During the early stages of clump formation transient thromboses occurred and the flow rate was markedly retarded to sluggish in many areas.

In the subsequent 24 to 48 hours the usual picture was that of progressive intravascular clumping with the formation of larger agglutinated masses, more permanent thromboses and increasing tissue damage. The clumps or agglutinations now could withstand intravascular stresses as they circulate throughout the organism, appearing occasionally in arterioles. Streamlining was completely disrupted even in the large veins draining the area under observation. The viscosity of the plasma increased. This was demonstrated by the appearance of resistance met by a free red cell as it turned over in its path down stream and entered successively larger currents. These intravascular changes together with the intermingling of broken red cell clumps, free red and white cells and a rare white cell clump reminded one investigator of "sludge." This term vividly pictures the very marked intravascular pathology little evidence of which would be found with routine autopsy methods.

The circulatory damage resulting from these intravascular pathological changes together with the increasing parasitization precipitated a stage of generalized clumping which represented a status of irreversible pathology progressive to eventual circulatory failure. The clumps or agglutinated red cell masses, which were initially formed by parasitized red cells only and later by both infected and normal red cells, were less fragile than previously and showed marked intrinsic cohesiveness. The clumps stuck to one another and would, therefore, stick to the phagocytes of spleen, liver and bone marrow. However, their great size presented a mechanical difficulty that the phagocytes could not overcome (this fact has been demonstrated by M. H. Knisely in unpublished data). White blood cells stuck to the endothelium in layers, plasma leaking and skimming were marked, the paste-like blood flowed very sluggishly and thromboses became numerous. There was a further increase in the viscosity of the plasma subsequent to the marked plasma leaking. These circulatory changes were regularly followed by the death of the bird within a few hours.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE PREPARATION OF A SUCRASE-FREE TAKA-MALTASE

TAKA-DIASTASE is, as is known, a mixture of different enzymes including maltose and sucrose-splitting factors.

Leibowitz[1] advanced the theory of a specific glucomaltase in taka-diastase distinct from taka-sucrase.[2] This view was opposed by Weidenhagen,[3] who postulated the existence of only one maltase identical with gluco-sucrase. Leibowitz and Hestrin[4,2] found a way to differentiate between the two disaccharide-hydrolyzing capacities of the taka-diastase owing to the greater thermostability and acid stability of the maltose-splitting factor.

The present paper describes a simple method for preparing maltase free from sucrase from the commercial taka-diastase (Parke, Davis and Company). The lability of taka-sucrase to reducing agents $N_2S_2O_4$, reported in a previous communication,[5] is exploited for this purpose.

2 gr of the commercial sample of taka-diastase were dissolved in 15 ml distilled water in a Cellophane bag and the solution under toluene dialyzed at room temperature for one day against running tap water and one day against distilled water, which was changed several times, until the solution is free of reducing substances.

The dialyzed solution (about 30 ml) was filtered into a glass-stoppered flask and mixed with 0.3 gr of sodium hydrosulfite. After 24 hours at room temperature, the $Na_2S_2O_4$ is removed by dialyzing the solution in a Cellophane bag for one day against running tap water and one day against distilled water, which is changed several times.

The dialyzed solution, showing only maltase activity, was highly diluted. To concentrate, dialysis against a 45 per cent. dextrine solution according to the method of Guy E. Youngburg[6] was attempted, but this method proved generally impracticable because of the reducing substances diffused in the concentrated solution from the dextrine. We succeeded

[1] J. Leibowitz, *Zs. physiol. chem.*, 149: 184, 1925; J. Leibowitz and P. Mechlinsky, *ibid.*, 154: 64, 1926.

[2] Cf. Sh. Hestrin, *Enzymologia*, 6: 193, 1940.

[3] R. Weidenhagen, *Ergeb. Enzymforsch.*, 1: 169, 1932; *Zs. physiol. chem.*, 216: 255, 1933.

[4] J. Leibowitz and Sh. Hestrin, *Nature*, 141: 552, 1938; 143: 339, 1939.

[5] J. Feigenbaum, *Biochem. Jour.* (1942) in press.

[6] Guy E. Youngburg, SCIENCE, 94: 498, 1941.

in finding a simple method of concentration, using 96 per cent. ethyl alcohol as the dialyzing liquid or "outside solution."

According to this method, 40 ml of the taka-diastase solution free from $Na_2S_2O_4$ is concentrated by dialyzing through a Cellophane bag for about six hours against 96 per cent. alcohol as "outside solution," the alcohol being changed two or three times.

During the concentration, part of the enzyme was precipitated and deposited on the Cellophane. After concentration the small residual solution (about 3 to 5 ml) was precipitated by the same volume of absolute alcohol, centrifugated and, together with the Cellophane bag (containing very active substance) dried in the desiccator over H_2SO_4. The yield was about 50 mg, *i.e.*, 2.5 per cent. of the original substance.

Using the same method, we concentrated solutions of the commercial taka-diastase without any treatment by reductants (which required only half the time of the concentration of the taka treated by $Na_2S_2O_4$). The yield was about 3 per cent. of the commercial product. Owing to the small quantity of the taka-diastase it sometimes happened that all the substance was precipitated and deposited on the Cellophane. In this case, the substance after drying was either carefully separated from the Cellophane, or pieces of the Cellophane containing the enzyme were placed in water and filtered off after the substance had dissolved. The substance precipitated on the Cellophane was even more active than the substance precipitated from the concentrated solution by absolute alcohol.

The dried product was tested for activity on maltose and sucrose. It was found that the product retained the full maltose activity splitting power of the original preparation but was practically inactive on sucrose.

This confirms the theory that taka-maltase and taka-sucrase are two distinct enzymes.

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A PLATINUM SCOOP FOR TRANSFERRING STERILE POWDERS

THE transfer of small quantities of sterile powder or chemicals to another container or a medium usually is accomplished with a loop or with a pipette having a wide bore. By such a procedure some powder usually is spilled or scattered on the table, which is obviously undesirable. To overcome this inconvenience, the writer has devised a platinum scoop (shovel) which will accomplish conveniently the transfer of powder from a container or test-tube to another container or a culture medium.

The scoop is made by folding a piece of platinum sheet into a U-shaped shovel which is attached with a platinum wire, a copper wire or lead glass to an inoculating needle holder. Fig. 1 illustrates three sizes: (a) 24 × 5 × 2 mm; (b) 25 × 5 × 3 mm; (c) 20 × 10 × 3 mm. Scoop (a) will hold about 0.17 grams of starch powder; (b), 0.23 grams; and (c), 0.45 grams.

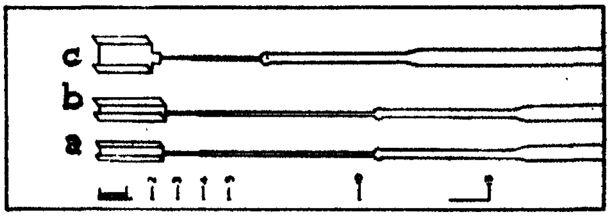

FIG. 1. Platinum scoops (a) 24 × 5 × 2 mm; (b) 25 × 5 × 3 mm; (c) 20 × 10 × 3 mm.

This scoop has been successfully used by the writer in adding sterile rice starch and starch and charcoal to various media for culturing *Endamoeba histolytica* and *Trichomonas vaginalis*. These scoops can be used also in analytic chemical weighings, and have several advantages over glass or metal spatulas.

This simple apparatus has the advantages of being readily sterilized by flame and requiring only a few seconds for cooling. Because of this, the transfer of sterile powder and chemicals is conveniently and neatly accomplished for a large number of culture tubes or containers in a short period of time.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE BETATRON

THAT the new atom-smashing Betatron, the most powerful X-ray in the world, may become a first-rank medical weapon for destroying malignant growths within the body, was reported by Professor Donald W. Kerst, who developed the instrument at the University of Illinois, to the Radiological Society of North America meeting in Chicago.

Mankind's most dreaded disease enemy might be attacked by this new weapon in either of two ways: first by use of its 20-million-volt X-rays, and, second, by using directly the electron beam which makes the X-rays.

The new machine is not yet ready for use in treating patients and no tests with it have as yet been made on living tissues. Dr. Kerst and his assistants, Philip Morrison and H. W. Koch, have, however, measured the penetration of the X-rays and electron beams through material equivalent in absorbing power to tissues. These tests show that, unlike the 400,000 volt X-ray machines now used to attack malignant growths, the rays from the Betatron would produce their maximum effect about one and a half inches below the surface of the body instead of at the surface. This means that the killing rays would have little effect on the skin and fat beneath it, but would deliver their full effect on growths within the body. Sending the electrons directly into the patient is the most promising way to use the Betatron treatment. At 20 million volts these electrons will penetrate as far as 10 centimeters (about four inches) and no farther. Thus there is no damage beyond the area of treatment.

The Betatron is a compact machine and relatively inexpensive for the voltage produced. It is about the size of an office desk, and has a control panel and condenser bank, each of about the same office desk size, and a motor generator. It is thus smaller than many X-ray machines of considerably less voltage now in use and requires about the same amount of power for operation.

NEW COLOR STANDARDS

FOLLOWING the Victory bicycle and the Victory typewriter, one of the newest subjects of standardization is color itself.

The new war standards to specify and describe color were explained to the press at a conference of the American Standards Association by Dr. Deane B. Judd, physicist of the National Bureau of Standards; Arthur C. Hardy, of the Massachusetts Institute of Technology, and Dr. Lloyd Jones, of the Eastman Kodak Company.

While research technicians have been measuring color by means of spectrophotometers for almost half a century, said Dr. Judd, there was no public agreement on how colors should be described. The shade known to colorimetrists as "9YR 7.2/4.5," for instance, might be called orange by the housewife, apricot by the dress manufacturer, yellow by the paint industry, and red by the druggist.

The new standards adopted in June include a system for designating 319 colors with consistent names, based on the Munsell Color Standard. According to this system, worked out by Dr. Judd and Kenneth L. Kelly at the National Bureau of Standards, "9YR 7.2/4.5" will henceforth be called "weak orange" for practical purposes, since it falls within that range. While theoretically the human eye can distinguish about ten million different colors, 319 names are ample for everyday purposes. But for specifying color, or when a more precise description is required, technicians will continue to use numbers.

This standardization of easily understood names such as reddish brown, olive brown, olive green, etc., was originally undertaken to meet the needs of drug chemists and pharmacists. But now that it has been adopted as a part of the American War Standards for color it will be a boon to practically all industrialists and merchants, including of course the ultimate consumer. Adopted by the Textile Color Card Association, the term "pinkish grey" will mean more to clothing buyers and wholesalers than "Algerian sand." However, consumers will doubtless continue to buy Algerian sands and Morocco scarlets, since the new specifications make it clear that they are not intended to replace names used in sales promotion.

The new standards coordinate these four principles of color specification and description: (1) The spectrophotometer shall be recognized as the basic instrument of color standardization. (2) Specifications shall be derived from the color system adopted in 1931 by the International Commission on Illumination. (3) For the popular identification of color, material standards shall be used according to the Munsell system. (4) A descriptive name, derived from the Munsell notation, is recommended wherever general comprehensibility is desired and precision is not important.

SULFA DRUG FILM FOR SURGICAL DRESSING ON BURNS

A NEW kind of surgical dressing for burns and wounds, expected to be of use to our armed forces, has been developed by Dr. Kenneth L. Pickrell, of the department of surgery of the Johns Hopkins University and Hospital.

It is a film which looks something like rough waxed paper but which carries a powerful wallop against germs in its 30 per cent. to 50 per cent. content of sulfadiazine. Dr. Pickrell reports in the *Bulletin* of the Johns Hopkins Hospital that these sulfa drug films have been used in more than 100 cases, about 50 of which were patients with burns. In 30 of the burned patients, bacteriological studies showed no evidence of infection. In the other cases bacteriological studies were not made, but no signs of infections were seen on inspection of the wounds and burned areas.

When used on burns, the burned surface and surrounding skin, should there be gross contamination, is first cleaned with a surgical detergent. The area is then

washed with salt solution, sulfadiazine or azochloramid solution and while the area is still wet the sulfa drug film is put on, over which a smooth, firm pressure dressing of gauze is applied. The sulfa film is left in place for three to five days, at the end of which time, in second degree burns, new skin will be forming. In third degree burns and in wounds or sores with discharge, the film may be renewed as desired. Since it is translucent, the surgeon can inspect the wound or burn without removing the film.

The sulfa film is made by preparing an emulsion of 3 per cent. sulfadiazine or 3 per cent. sulfanilamide, 2.5 per cent. methyl cellulose (this is one of the newer plastics materials), 3 per cent. triethanolamine and 0.5 per cent. sorbitol with 50 per cent. alcohol or acetone to make 100 cubic centimeters (about three ounces). This is sprayed on a smooth, horizontal glass surface with a pressure gun or paint spray apparatus and allowed to dry, after which it is removed in a single sheet.

The sheets can be made any size, but at the Johns Hopkins they are cut in three-inch widths and rolled just like any bandage. They keep well and can be sterilized by dry heat. They are light in weight and can be packed easily in sheets, tablets or rolls.

Physicians who have seen them on visits to the hospital have been interested and enthusiastic about them and several of the larger commercial houses are beginning to prepare them. The films were developed following Dr. Pickrell's discovery that a solution of sulfadiazine in triethanolamine was effective in treatment of burns, the successful use of this solution in combating sinus infection, complications of the common cold, irrigating infected wounds and sinuses, preparing the surgical site for operations around or in the eyes and various body openings, and for fighting infection in skin grafts. Certain disadvantages of this solution, such as slow drying time and the thinness and fragility of the film it formed, led to development of the stronger film with methyl cellulose.—JANE STAFFORD.

DECLINE IN NUMBERS OF CARS AND TRUCKS ON ROAD

GASOLINE rationing, tire shortage and wartime restrictions on travel in general have contributed to a very decided decline in road-borne traffic, according to John T. Lynch, highway engineer-economist of the Public Roads Administration, in a report to the Highway Research Board meeting in St. Louis. There has been a steady decline in number of vehicles of all classes, though the ratio of trucks to cars has risen. A higher percentage of trucks are running without loads, but trucks that do have loads are carrying bigger ones.

Mr. Lynch reported the results of a country-wide survey of country highway travel, in which more than 500,000 vehicles were counted and classified and more than 50,000 trucks were weighed at 486 stations.

Traffic declined steadily from February to August of this year, as compared with figures for the same months in 1941. The decline was checked in September. This was due in part, Mr. Lynch thinks, to the passing of the normal vacation season, which this year was a period of very light traffic because of the large number of persons who did not travel by automobile.

The increased proportion of trucks running light may be traced partly to the use of light trucks as substitutes for buses and personal cars in getting workmen to their jobs, partly to the fact that many of the trucks were engaged in carrying materials to cantonments, airfields and other places where they had no chance to pick up return loads. The cargoes of trucks that did have loads were so much greater than they had been in pre-war times that despite the decreased number of loads the number of ton-miles of load carried by truck, for the country as a whole, is almost as great as in 1940. In the Pacific Coast region, indeed, it is 22 per cent. greater.

THE NICKEL-LESS "NICKEL"

THE new nickel-less nickel now in circulation contains 56 per cent. copper, 35 per cent. silver and 9 per cent. manganese, concluding a year-old research project of the Treasury, according to Mrs. Nellie Taylor Ross, director of the United States Mint.

Over a year ago, when the shortage of nickel first became acute, stainless steel was suggested as a replacement for 75 per cent. copper and 25 per cent. nickel in the old five-cent piece. Then came Pearl Harbor, greatly reducing our imports of chrome for stainless steel.

"So we tried silver and copper next," said Mrs. Ross. The trouble was that when this alloy was tested on slot machines, it was flatly rejected by certain types of vending machines, widely used for cigarettes and candy. The silver and copper were such good conductors of electricity that the principle of electrical resistance invariably bounced the experimental coin right into the rejection slot.

This problem was finally solved by adding manganese, and then Congress passed a bill authorizing the new coin. Manganese, being a poor conductor of electricity, reduced the conductivity of the copper-and-silver alloy to the approximate level of the old copper-and-nickel coin. But too much manganese made it too brittle to be rolled into the flat metal strips from which the coins are stamped. After further experimentation, it was found that 9 per cent. was the minimum amount of manganese required to operate all vending machines.

A new problem immediately arose, but not a serious one, Treasury spokesmen say. The old nickels were "cold rolled," that is, the molten metal was poured into long, thin, rectangular molds to form ingots, which were allowed to cool and harden, then pressed into flat strips. However, manganese made the ingots so hard that new annealing furnaces had to be installed in order to heat the ingots several times during the rolling process. Ingots for the new "nickels" are not remelted, but they must be heated to 1,200 degrees Fahrenheit to facilitate rolling.

The new five-cent piece is bright and shiny, resembling a new dime or quarter more than the old nickel. However, it tarnishes more quickly and turn a strange yellowish-gray color. If you're wondering whether you have one in your pocket, look at the Monticello design on the back. The new issue has the mint mark directly over


WAR
needs the wires
this Christmas
War can't wait—not even for Christmas. So please don't make Long Distance calls to war-busy centers this Christmas unless they're vital.... BELL TELEPHONE SYSTEM

the dome: "S" for San Francisco, "D" for Denver, or "P" for Philadelphia. This, by the way, is the first time the mark of the parent mint in Philadelphia has ever appeared on a coin. Adoption of the new coin is distinctly a war measure. The Act authorizing it expires on December 31, 1946, by which time it is hoped the war will be over.

THE PENNY

ANOTHER consumer commodity has become critically scarce, the penny. Yes, the humble bronze one-cent piece is a commodity like any other, manufactured to meet consumer demand. But the demand is growing faster than the supply, there are no reserve stocks, and no copper available to make new ones.

The Treasury is experimenting with substitute materials, the favored ones now being plastics or steel, coated with less than 1 per cent. of zinc to keep it from rusting. But steel, zinc and plastics are all scarce.

Meanwhile tons of critically vital copper lie hidden away in bureau drawers and baby's banks in millions of American homes. Last year four thousand tons of copper went into pennies. This is enough to meet the combined copper requirements of building 2 cruisers, 2 destroyers, 1245 Flying Fortresses, 120 field guns and 120 howitzers. If every American family could unearth just 40 pennies hidden away in banks and boxes, this would exactly equal last year's production, one and a half billion pennies, four thousand tons of copper.

"We must get those hidden pennies back into circulation," says Mrs. Nellie Tayloe Ross, director of the United States Mint. "If the people only realized the importance of this, I know that every penny bank in the country would immediately be converted into war stamps.

"For the past two years the Mint has been working 24 hours a day, including weekends," said Mrs. Ross, "to supply the coins which are essential to the economic life of the Nation. Last year's output of 1½ billion pennies was one tenth of the Mint's total penny production of the last 150 years."

And still the demand grows. War conditions have brought an unprecedented demand. Federal and State sales taxes consume pennies, so do rising prices. Many lunch counters now charge 6¢ for a cup of coffee or a piece of pie, many commodities are now priced at odd figures such as 32¢. Penny vending machines have increased. And of course the Nation's total volume of business has jumped tremendously.

Mrs. Ross, describing the Treasury's difficulties in finding a substitute material for the copper in pennies, concludes "Everything is scarce." The first suggestion was zinc, which was promptly put on the critical list. Plastics were investigated exhaustively, only to become too valuable for war needs. Steel, now being considered, is also scarce and the Treasury has not abandoned its earlier experiments with plastics.

There is no intention of producing half-cent pieces, as has often been suggested, Mrs. Ross said. This would only multiply the problem by two.

The only abundant supply of coins which the Treasury has in stock is the silver dollar. Does any one want to save silver dollars instead of pennies? While the new "nickel" is now composed of 35 per cent. silver, the Treasury could not use any appreciable amount of silver in pennies without making them worth more than five cents.

ITEMS

THAT water running off flight strips during heavy rainstorms constitutes one of the major engineering problems connected with emergency aids to aviation was reported by Carl F. Izzard, Public Roads Administration engineer, at the meeting of the Highway Research Board. A "rain-making" device has been built for the experimental study of this problem. It consists of a set of pipes with sprinkler nozzles, capable of delivering a synthetic rainstorm of any desired violence over a measured area, together with arrangements to catch and measure the water that runs off the surface. It has been used on both paved and turf-covered flight strips, and the data which have been accumulated are now being analyzed as rapidly as possible. Results will be published in the near future.

MANY factors influence plants in their use of elements taken from the soil to produce nutritional value, was pointed out by Dr. L. A. Maynard, of the U. S. Department of Agriculture, at the National Industrial Chemical Conference. With the same kind of soil nutrients available, but different rainfalls, two crops of bread wheat will have entirely different protein contents. The amount of ascorbic acid, one of the most important of vitamins, in tomatoes is powerfully influenced by the number of hours of sunlight per day received by the plants. Light intensity, as well as length of daylight period, affects the vitamin content of certain fruits and vegetables. Much research on this subject yet remains to be done. Consideration needs to be given to yields of nutrients as well as to tons or bushels per acre, to nutritional quality as well as to market quality.

THOSE who eat in restaurants, even the best of them, are being deprived of about three fourths of the vitamins they should be getting from vegetables. Actual figures on vitamin losses from restaurant-cooked vegetables was reported by Dr. Robert S. Harris, of Massachusetts Institute of Technology, to the American Dietetic Association. Dr. Harris advised restaurant eaters to eat early and concentrate on raw vegetables. In his study, Dr. Harris selected a restaurant using superior cooking and serving technics. In spite of this, the average loss of anti-scurvy vitamin C from vegetables during cooking was 45 per cent., and the loss of thiamin (vitamin B_1) averaged 35 per cent. The large loss was attributed both to the destruction by heat and to the fact that the cooking water in which the vitamins are soluble was discarded. During the time the vegetables were held on the steam table before serving there was a further vitamin loss of about 15 per cent. Only about a fourth of the original vitamin content of the vegetables actually reached the consumer. It is evident, Dr. Harris pointed out, that the customers who eat earlier and who eat more raw vegetables will be better fed.

// SCIENCE

VOL. 96 FRIDAY, DECEMBER 18, 1942 No. 2503

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE ORGANIZATION OF BIOLOGY AND AGRICULTURE

By Dr. ROBERT F. GRIGGS

CHAIRMAN, DIVISION OF BIOLOGY AND AGRICULTURE, THE NATIONAL RESEARCH COUNCIL

OVER and over again as I endeavor to facilitate the contributions of biology and agriculture toward winning the war, I encounter the unorganized and incoherent condition of our group of sciences. I have come to believe that this lack of organization, and the lack of unified objectives that goes with it, is of itself partly responsible for the comparatively ineffective application of biology and agriculture to the needs of a total war.

To assist in clarifying our functions and our responsibilities, I have constructed an organization chart (Fig. 1). In its conception the chart is entirely abstract. Its contact with the present situation comes through the numbered references in the appropriate boxes to the national technical societies in whose hands to a large extent lies the professional guidance of those arts and sciences by which man produces his food and the organic raw materials which he uses in his civilization.

To point out that the products of the soil constitute the most fundamental and the only really essential factors in man's existence is to state a truism to which there is no occasion to call your attention. The chart is presented, rather, to emphasize the complexity of the problem of organization which is faced by biology, using that term in its widest sense including its applications.

The outstanding feature of biology and agriculture, and it must immediately occur upon any consideration of these fields, is the number and diversity of the organizations included in the group. Whereas chemists of all sorts support one strong chemical society,

biologists have set up a number of weak societies. The problem of organizing biology and agriculture is altogether too similar to that of consummating the consolidation of the several weak Protestant churches frequently found in a rural community.

In its bulletin on "Industrial Research," p. 250, the National Resources Planning Board gives an organization chart for physics in America. It is neatly set forth in seven boxes, which include the national societies and culminates in the American Institute of Phys-

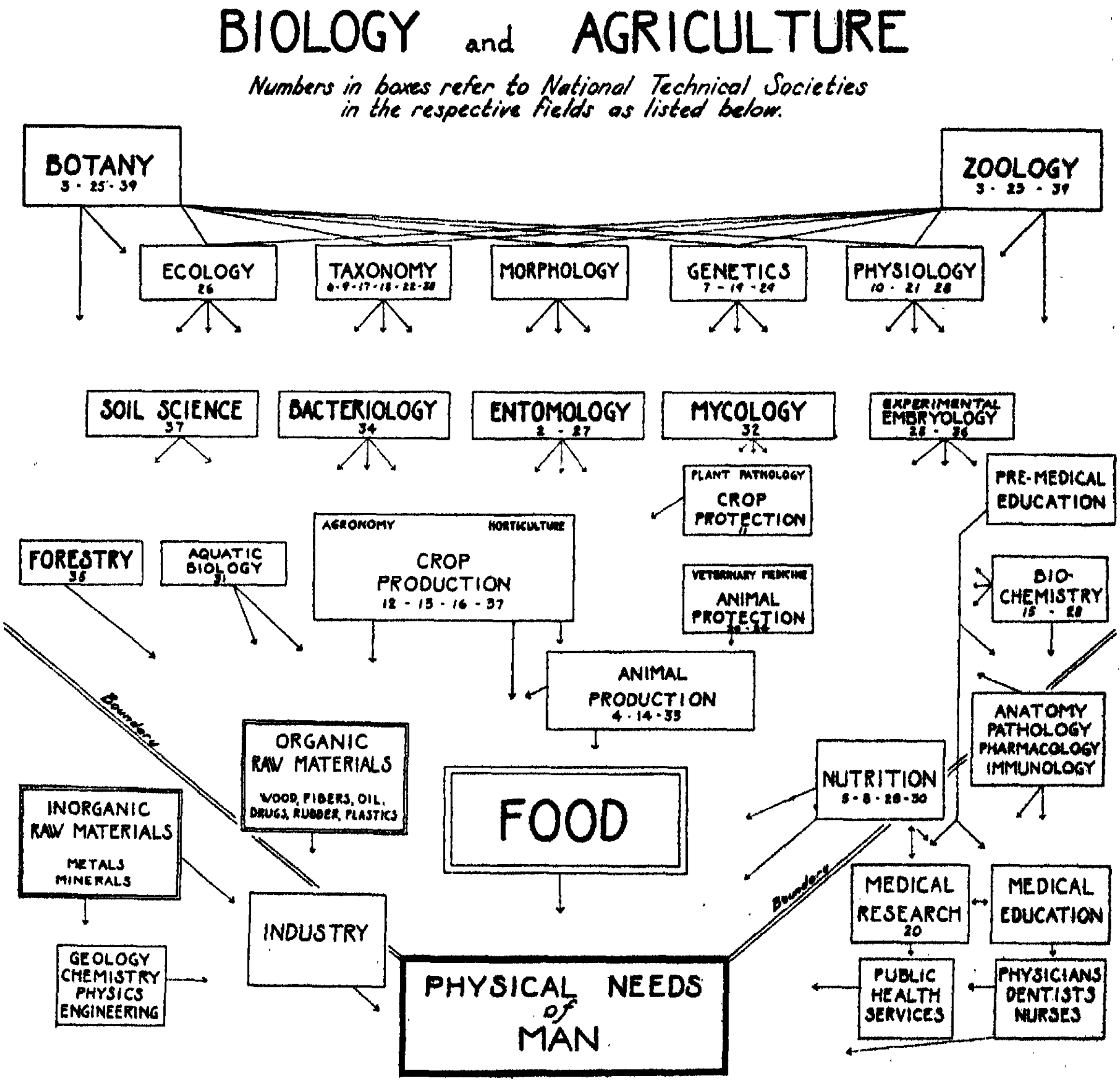

FIG. 1. Organization Chart.

National Technical Societies: 1. American Association of Anatomists. 2. American Association of Economic Entomologists. 3. American Biological Society. 4. American Dairy Science Association. 5. American Dietetic Association. 6. American Fern Society, Inc. 7. American Genetic Association. 8. American Institute of Nutrition. 9. American Ornithologists' Union. 10. American Physiological Society. 11. American Phytopathological Society. 12. American Society of Agricultural Sciences. 13. American Society of Agronomy. 14. American Society of Animal Production. 15. American Society of Biological Chemists, Inc. 16. American Society for Horticultural Science. 17. American Society of Ichthyologists and Herpetologists. 18. American Society of Mammalogists. 19. American Society of Naturalists. 20. American Society of Parasitologists. 21. American Society of Plant Physiologists. 22. American Society of Plant Taxonomists. 23. American Society of Zoologists. 24. American Veterinary Medical Association. 25. Botanical Society of America, Inc. 26. Ecological Society of America. 27. Entomological Society of America. 28. Federation of American Societies for Experimental Biology. 29. Genetics Society of America. 30. Institute of Food Technologists. 31. Limnological Society of America. 32. Mycological Society of America. 33. Poultry Science Association. 34. Society of American Bacteriologists. 35. Society of American Foresters. 36. Society for Experimental Biology and Medicine. 37. Soil Science Society of America. 38. Sullivant Moss Society. 39. Union of American Biological Societies.

ies. Probably physics is oversimplified by this chart. But could anybody reduce biology and agriculture and their societies to similar simplicity? The representation of our field in the 31 boxes used in the chart has, in fact, required considerable compression and generalization and the omission of many important relations.

A proper organization chart which shows by straight line connections dependence and responsibility is impossible for our group. One could so connect entomology and crop protection, for instance, but medicine and animal protection also are similarly dependent on entomology, and if the application of each of our sciences were thus shown our chart would become an unintelligible mass of crisscross lines. Several of our sciences have such varied responsibilities that the connections of each would make a spiderweb reaching into almost every box on the chart. On the other hand, most of the applied fields draw from a wide variety of underlying sciences. Forestry, for instance, depends on all but one of the sciences placed higher on the chart. In view of this complexity it was impracticable to show connecting lines but, instead, some of the interrelations were indicated by arrows. For example, an arrow from forestry toward raw materials suggests the chief function of forestry, but there was no opportunity even for suggesting other important functions of forestry such as controlling erosion, harboring wild life and providing recreation areas.

The fact is that any adequate representation of our group would require for almost every member a separate organization chart, only less complex than that presented for the whole. But separate charts would necessarily leave off the interconnections between the different fields and our problem lies exactly there, for these interconnections are fully as important as the special responsibilities of each science.

The writers of the bulletin on "Industrial Research" made some rather sharp criticisms of our field, pointing out that biology has not won anything like the acceptance in industry that has come to the physical sciences. They recommended that we establish an "American Institute of Biology" comparable to the Institute of Physics. If this were construed to mean that biology has not rendered as great practical services as have the physical sciences, it would be quite incorrect. The great public institutions, state and federal, devoted to scientific agriculture through the applications of biology have no counterpart in the physical sciences. The "colleges of agriculture and mechanic arts" contemplated by the Morrill Act have, in fact, gone much further in agriculture than in engineering. One reason why industrial concerns have few biologists on their staffs is that, whereas they know they must pay for consultants in engineering, they expect to get expert advice in agriculture for nothing from government employees.

Whether a system of private-paid or of public-free consultants is better public policy is a large question into which there is no occasion to enter here. But regardless of the merits of this question, there can be no doubt but that the man who collects fees of a hundred dollars a day holds himself in higher esteem and is more highly regarded by his neighbors than the man who renders the same service gratis. Biologists would strengthen both their own self-esteem and the standing of their professions if they curtailed the consultation services they render without compensation. In the case of men attached to public institutions, it would increase the prestige of both man and institution if fees were charged for their consultations. The fees might well go into the institutional treasury if the institution gave proper recognition to the value of its men by way of salary adjustments. The biologists who are called into consultation find upon rubbing shoulders with engineers employed in the same way that, both in ability and in the value of the services they can render, they measure up to the engineers.

Two other important differences between physics and biology are manifest. First, despite the complexity of modern physics and the disappearance of the old frontiers which used to separate it from chemistry, the physicists have developed a strong guild consciousness which brings to them a sense of solidarity not possessed by biology.

The chief influence which pushes us apart is the necessity for diversified specialization. It is clear that there can be little common understanding of details among our different fields, *e.g.*, forestry and veterinary medicine; and it is equally clear that there is no possibility of important progress in any scientific field except by concentration on comparatively limited objectives. Is, then, our case hopeless? I think not. The same degree of specialization is necessary in physics or in chemistry, where its disruptive tendency is greater by reason of the vastly larger number of entities with which chemistry must deal. But physics and chemistry both retain an esprit de corps and a guild consciousness which hold them together. The source of this unity lies, I believe, in common points of view.

Is there, latent, enough of a common point of view among all the groups associated under biology to bind them together with a degree of unity far beyond that now realized? I would not presume to answer this question in its entirety, but I think any biologist, figuratively looking out of the box in which he is placed in the chart, will recognize at least that he has much more in common with the people in neighboring boxes than is given expression to in our organization.

Second, the organization of physics does not include the applications of the science in engineering. In view of the manifest advantages to both physics and to engineering of their separate organizations which permit each to make its own distinctive contribution, it might be concluded that biology and agriculture should forthwith be similarly separated. Such separation looks right logically and will probably be desirable—ultimately. But in my opinion separation of agriculture from biology at the present time would be unwise. Biology is contributing so much to the development of agriculture and agriculture is stimulating the advance of biology so greatly that both would lose by separation at this juncture. Indeed I believe it can be demonstrated that a closer integration would increase the progress of both for some time to come. If this be correct, we should use every means to bring the two closer together.

The need for integration between biology and agriculture is increased by the war, for war at once puts greater emphasis on the practical and makes greater demands for innovations and these must be based on the principles of pure science.

Belief that a strong organization of the biological sciences would be advantageous is in no way novel or original to the writer. Some years since, the Union of American Biological Societies was organized and more recently the American Biological Society was launched. Both have been primarily concerned with promoting *Biological Abstracts,* a highly desirable project in itself but no adequate objective for such far-reaching organizations. Their initiation was indeed something like putting the cart before the horse. A strong federation of biologists would certainly feel the need of an abstracting journal and would support one. But such a journal can not create a federation.

I believe that all branches of biology (in the broadest sense) realize to some extent the advantages that would accrue from a strong federation of biological interests and, I think, all elements if properly treated will go along with steps to develop the bonds supplied by our many common interests. But such a living organization could not be produced by fiat. The present paper is submitted as an analysis of our actual situation. It does not include a program of action. It is my feeling that any changes in the relationships of our constituent groups will have to grow slowly and that to a large extent they will have to be initiated by the groups themselves.

Is it worth the great effort which will be required to federate the biological sciences? What may be expected from the life sciences in the years to come? During the past century the physical sciences have transformed our environment by producing all sorts of mechanical conveniences which have freed mankind from the long hours of toil before required to produce the bare necessities of existence. Among the life sciences this last century has been a time of preparation. We have learned how to protect man from many of the diseases which heretofore carried him off before his time. We have learned much of heredity and of the principles which underlie the production of improved domestic animals and crop plants. We are learning through the application of the new science of nutrition that man properly nourished maintains a vigor in life never before thought possible.

Such things have been slowly emerging through the period that is closing. The years ahead will see applications of biology to the betterment of human conditions such as we can now hardly imagine. This development will require all the detailed specialized technical tools that we possess—but more, it will require broad insight and applications of biological principles to world problems by men of affairs. Will the professional biologists play their rightful roles in this future, or will they barter their heritage for a mess of specialities?

Specialists often fail to recognize the bearing of advances in cognate fields on their work. If there were some way of bringing home to them their own need of relating their work to fields other than their own, the problem of the organization of biology and agriculture would be well on the way to solution, for there would be a spontaneous desire to bring together information and ideas from fields at present sharply separated. One trouble is that it is so much easier to follow developments in one narrow line than to keep abreast of advances along a wide front, and men will follow the line of least resistance. But lines of specialization are soon worked out and the men who survive have to shift into other lines. To adjust himself successfully to changing conditions, a man needs the broad outlook which can be most readily maintained by diversified contact with several fields.

Several correspondents have given the opinion that biologists are suffering from an inferiority complex and that this is one of the causes of our difficulties. It was partly with this idea that I suggested above the advisability of more paid consultative work by biologists and agriculturalists. Certainly it is advantageous for men in academic circles to have contacts with men of affairs. College and university men are too used to being taken care of by their institutions. We need to learn better to take care of ourselves, and in so far as we do so we will command a larger place in the scheme of things.

There are two main and fairly distinct, though considerably intertwined, avenues by which biologists serve society. These are in addition to the less direct

general educational services that come from the cultural values of instruction in biology, which our fields share with other sciences, arts and letters.

The first and oldest of these two services is as preparation and background for the medical sciences. In the old days before the development of scientific medicine all of biology contributed thus to medicine. In the beginning the physician had largely to gather his own drug plants and so the early botanists were physicians who had specialized into a knowledge of plants. This was true of most of the old herbalists, of Linnaeus and of Asa Gray.

But the rise of pharmacology, which proved that comparatively few of the old herbs possess important therapeutic value, and the achievements of synthetic chemistry which produce more and more drugs in the laboratory took away the practical value of the old herb doctor's botanical lore. Thus botany came to play a minor part in medicine.

By this development botany was deprived for the time being of its chief professional outlet. At the same time the rise of comparative anatomy, embryology, physiology, and especially of experimental zoology, accompanied by the researches in medicine itself which led to the establishment of scientific medicine, greatly increased the importance of zoology to medicine and gave a greatly enlarged outlet to students of zoology. The improvements brought about in the treatment of disease likewise vastly expanded the opportunities for service in medicine and increased correspondingly the number of physicians. The training of recruits to the army of physicians, which now numbers above 150,000 in this country alone, is in itself a very large undertaking—large enough to absorb the energies of a considerable body of men.

Thus it has happened that, without looking beyond medicine with its preparatory and cognate subjects, the zoologists have found abundant profitable and useful scope. This is not to charge that zoologists have limited their activities in any narrow way to medical interests. The reverse is quite generally the case. Very often the zoologist whose students go largely into medicine undertakes researches as far removed from medical application as possible. But the fact that medicine is the destination of the majority of students who take zoology has given that science a bent which produces the largest element of disunity in our organization as may be seen by observing how the zoological and medical aspects of biology stand apart from the agricultural in our chart.

While zoology[1] has benefited very greatly by thus having an outlet for service through medicine, it has also suffered the loss through that outlet of many of its best men. Every teacher of zoology knows that many of the students best fitted to become zoologists go into medicine. If the pull of the medical sciences were not quite so strong, zoology itself might be stronger. If opportunities for placement of zoologists in premedical fields had been less, zoology might have entered more completely into the whole of its domain. As it is, it has left large segments of the animal sciences to be developed by other hands.

Both zoology and agriculture have lost by this separation. There are, for instance, among the zoologists many able geneticists. Their achievements in discovering and formulating the laws of inheritance have been outstanding. Among them is the only American biologist who has been awarded a Nobel prize. Few of these men, however, are in touch with the Society for Animal Production. Out of roughly a thousand members of the American Society of Zoologists only eleven are also members of the Society for Animal Production. Perhaps it is a direct consequence of the separation of these interests that during the four decades in which the Mendelian Theory has been available, animal breeding has brought forth no achievements comparable in economic returns with hybrid corn or even with the large number of polyploid flowers and fruits recently produced by plant breeders.

By all the logic of the natural relations of subject matter zoology should be as much interested in parasitology, entomology, veterinary medicine, animal production, animal breeding and animal ecology as in medicine. But as a matter of fact, zoologists have been so much occupied with premedical interests that the agricultural animal sciences have been largely left to Experiment Station workers, and there has been little community of interest between the two groups.

It is not intended to suggest that the same individual could attain proficiency in more than one branch of science. The significant thing is that the organizations of the two groups of animal sciences have drifted apart. Perhaps the most striking illustration of this divergence is that between zoology and entomology. Entomology grew up in the service of agriculture even more than zoology and medicine have grown together. While the American Association of Economic Entomologists was founded in 1889, it was not thought necessary until 1906 to foster the development of the science itself, as distinguished from its applications, by establishing the Entomological Society of America. Although insects are as much a

[1] Perhaps I am using zoology in too narrow a sense here. For present purposes I am drawing my definition of the science itself from the objectives and attitudes of the American Society of Zoologists, which I recognize is not an entirely fair procedure. Yet, that ought to be the proper way to find out the nature of zoology.

part of the domain of zoology as are marine invertebrates, the members of the American Society of Zoologists have concerned themselves very much more with the latter than with the former. Students of marine invertebrates are sufficiently at home in that society that they have not set up a specialized society of their own comparable with the entomological societies.

But while students of other groups of invertebrates are generally members of the American Society of Zoologists, the entomologists generally are not so affiliated. Less than one per cent. of the Association of Economic Entomologists and only six per cent of the members of the Entomological Society of America are members or associates of the American Society of Zoologists.

In the early days of their development both botany and zoology prided themselves on being "pure" sciences and disdained applications to industry and agriculture. Finding adequate outlets in the development of the medical sciences, zoology has maintained this position, though with little of the "holier than thou" attitude with which both botanists and zoologists regarded applied scientists forty years ago. To this day, however, comparatively few members of the American Society of Zoologists are professionally engaged in applied science. So far as medicine is concerned, the separation of the pure sciences underlying the applied medical arts has been enforced by strong professional esprit de corps among physicians as well as among zoologists.

Botany, however, was compelled to take a different course. Deprived of its original usefulness by the decline of the herb doctor, botany found itself without adequate outlet for the energy of its devotees or their students. It was forced to make itself useful to agriculture. With the passing of time that connection has broadened and strengthened to the mutual advantage of both participants.

It is instructive to remember that in the beginning botanists were as much traditionally opposed to economic work as any other scientists. One of the ablest of mycologists, for example, who was forced in his youth to accept a position in an Experiment Station and there made an outstanding contribution toward the control of potato scab, always as long as he lived professed to be ashamed of this work and devoted the balance of his life to the study of fungi with no possible economic importance. But this man stood alone for many years before his death and a large majority of his students took up economic work. Again the extent to which the integration of botany and plant pathology has gone may be judged by the fact that of the total membership of the Phytopathological Society, approximately 20 per cent. maintain membership in the Botanical Society of America.

The most significant advances among the plant sciences during the last decade have occurred in plant physiology. Here more than anywhere else the interdependence of pure and applied science has been manifest. As long as plant physiology remained a pure science confined to old line university departments of botany, it never amounted to much. Indeed beans and corn were about all the materials used and the work did not get beyond the demonstration of a few simple principles—just enough to show that the subject had potentialities.

But when agriculture began to ask questions about the scientific basis of plant production and coupled these questions with appropriations for their answer, plant physiology began to advance. This at once brought into high relief our lack of understanding of the fundamentals of that field. As a result the science itself has evolved, up to now, rather more than its applications. But within the last few years these advances in fundamentals have permitted applications of rapidly increasing importance, starting a development which bids fair to become one of the most important in all biology.

Because of its importance to medicine, bacteriology is closer to zoology than is any other of the plant sciences. There are, indeed, about as many teaching positions requiring a combination of bacteriology with zoology as with botany. But bacteriology in its own right is no more a medical subject than is chemistry. Like chemistry, its applications reach into almost every field of biology and agriculture. It was impossible, therefore, adequately to represent its relations on our organization chart. Unlike chemistry, however, bacteriology has permitted the importance of its applications to dwarf the growth of the science itself. A parallel situation would be presented if chemical engineering had attempted to advance without physical chemistry. It seems likely that if the bacteriologists could set aside some of their best men to develop the pure science of bacteriology for its own sake, the fundamental principles so brought to light would lead to greater applications even than those which have been made already.

Physiology is in many schools merely *human* physiology. There is very slight contact between the physiological departments of medical schools and *plant* physiology. Yet in its fundamentals physiology has as broad an applicability as any of the biological sciences. Many have emphasized the importance of *general* physiology and most agree that it ought to be widely taught, especially for the broadening of men preparing for medicine, but it has never flourished. The reason lies probably in the bias of the premedical students who flood our biology departments. They are continually pressing for courses more and more nearly similar to the medical work to which they look

forward. Most medical schools as well as most departments of biology deplore this tendency and would be glad to compel premedical students to broaden the biological base on which to build their medical work. But they have not been strong enough to force the students into the preparation which would be best for them, and in this situation general physiology has languished.

Biochemistry, perhaps even more than physiology, is properly a field of general biology. But many departments of biochemistry instead of representing the fundamental science are mere adjuncts of medical schools. At the other extreme "Agricultural Chemistry" developed independently, starting from very narrow applications of chemistry to fertilizer analysis and such practical matters. Happily the progress of the science has brought about considerable rapprochement between the agricultural and the medical biochemists, but there is still far too wide a gap between them. Like physiology, biochemistry is in its nature more properly a pure science which (like physics) should be strongest in universities, rather than an applied science (like engineering) strongest in technical schools. In suggesting this I am not pleading especially for the pure sciences, for I believe it can not be gainsaid that strong departments concerned with these sciences for their own sake would extend and increase the usefulness of their applications.

The scarcity of departments of pure physiology and of pure biochemistry is sufficient evidence that the biological sciences in the universities are not strong enough to stretch out and occupy all of the fields of biology which should be cultivated. They need help here from the applied branches. Agriculture and medicine should unite in demanding that the universities establish departments of physiology, of biochemistry, and of bacteriology to prepare students for the technical schools with no more emphasis on applications than is given by university departments of physics preparing students for the engineering schools. If this were done, all biology would be greatly strengthened. The corresponding departments in the technical schools would find their own hands strengthened and would grow into an increased usefulness which would be hard to envisage at the present time.

All biological sciences spring from the same root. They are like a tree with many branches. Some of the branches, however, have grown so vigorously and reached such distances from the trunk that they have forgotten their origins and consider themselves independent trees. This analogy is due to C. V. Taylor of Stanford, a zoologist, who is distressed by the degree of separation that has developed among the different members of our group. Taylor points out that all living things are made of a protoplasm which, despite the widely diverse types into which it develops, remains on the whole surprisingly uniform in fundamental character throughout. The laws of its evolution and of its inheritance are the same everywhere. To a very large degree even its cellular structures are constant.

In so far as the analogy of the growing tree is applicable, it will be recognized that it is just those branches which grow most vigorously that get farthest away from the main trunk. Also, in the tree there is dead wood and there are rotten branches which may not be detected until stress and storm search them out. Likewise, on a tree leaves which almost touch may draw their sustenance from different branches which may have grown independently for a long time so that the only way to get from one to the other is to go clear back to the root. In the tree the original connection to trunk and to roots is essential. If it is severed at any point, every part beyond the cut dies.

The question really before the assemblage of sciences now grouped under biology and agriculture is whether we are comparable to a tree with a single trunk or whether we are more like a bush with many trunks from the same root. If we are like a bush, the health of any one branch is of little concern to the others. Indeed, when a branch is cut out of a bush the others grow all the better, profiting from the removal of competition. But if we are like a tree, then it behooves us to look after the health of the trunk that supports us all.

Is biology like a bush or is it like a tree? The question can be answered with assurance only with the passage of time. It is permissible, however, to make one observation: Bushes rarely attain any great height and they are mostly shortlived. The really tall and permanent growths are all trees.

OBITUARY

JOHN JOSEPH RONAN

ENEMY torpedo action on October 14, 1942, tragically ended the career of a young Canadian scientist, John Joseph Ronan, field officer of the Geological Survey of Newfoundland. On leave from St. Francis Xavier University, Antigonish, Nova Scotia, to whose staff he had just been appointed, Mr. Ronan was proceeding to Newfoundland to resume field work on war minerals when he was numbered with 137 who lost their lives in the sinking of the Newfoundland Railway Steamship *Caribou* in Cabot Strait.

John Joseph Ronan was born at Antigonish, Nova

Scotia, on April 18, 1917, the son of Dr. and Mrs. M. F. Ronan. He received his early education at Morrison School and graduated in 1935 from St. Francis Xavier University with the degree of B.Sc., *magna cum laude*, a few weeks after his eighteenth birthday. Some of the results of his petrographical studies for the M.A. degree at the same institution were incorporated by his professor, the late Dr. Donald F. MacDonald, geological adviser on Panama Canal work, in "Contributions to Panama Geology" (*Jour. Geol.*, 45: 655–662, 1937).

In 1936 Mr. Ronan was awarded an assistantship in the Department of Geology at the Catholic University of America, Washington, D. C., which position he occupied for the next three years. In 1939 he went to the University of Wisconsin as holder of the Charles R. Van Hise Fellowship and remained at Madison until June, 1942, as research assistant.

Laying a broad and firm foundation of field experience for his professional career, Mr. Ronan spent the summers of 1936 to 1940 as field assistant with parties of the Geological Survey of Canada in Nova Scotia, Quebec and Ontario. The Department of Mines of Nova Scotia in 1941 made him a grant to study the igneous rocks of Guysborough County; this was to have been the subject of his doctorate dissertation at the University of Wisconsin.

Unselfishly interrupting his graduate research, which was nearing completion, Mr. Ronan last summer assumed charge of one of the field parties of the Geological Survey of Newfoundland to investigate iron and strontium resources, and after the regular field season consented to supervise further diamond drilling operations on these ores, which are important in the war effort. He met his death when about to take up his winter duties.

In grateful tribute, the mineral location at Boswarlos, Port au Port Bay, west coast of Newfoundland, to which John Joseph Ronan was devoting his scientific training, henceforth will be known officially as the "Ronan Strontium Deposit."

A. K. SNELGROVE

GEOLOGICAL SURVEY OF NEWFOUNDLAND

RECENT DEATHS

DR. HARRISON E. HOWE, editor of *Industrial and Engineering Chemistry*, died on December 10 at the age of sixty years.

ROBERT PEELE, professor emeritus of mining engineering of the School of Mines of Columbia University and editor since 1917 of "The Mining Engineers' Handbook," died on December 8. He was eighty-four years old.

DR. ALFRED BAKER SPALDING, since 1930 emeritus professor of gynecology and obstetrics of the School of Medicine of Stanford University, died on November 27 at the age of sixty-eight years.

DR. FREDERICK MARK BECKET, consultant to the Union Carbide and Carbon Corporation, New York, N. Y., died on December 1 at the age of sixty-seven years.

CHARLES W. FREDERICK, head of the Science Division of the lens factory of the Eastman Kodak Company at Rochester, N. Y., died on November 29 at the age of seventy-two years.

THE death at the age of eighty-four years is announced of Sir Henry Miers. Sir Henry was Waynflete professor of mineralogy at the University of Oxford from 1895 to 1908; principal of the University of London, 1908 to 1915, and vice-chancellor of the University of Manchester and professor of crystallography, 1915 to 1926.

Nature records the death of Dr. Alfred Baker, emeritus professor of mathematics of the University of Toronto, where he occupied the chair of mathematics from 1887 until 1919, president in 1915 of the Royal Society of Canada, on October 27, at the age of ninety-four years; of Dr. J. N. Collie, F.R.S., emeritus professor of organic chemistry of the University of London, on November 1, at the age of eighty-three years, and of Dr. J. C. Schoute, emeritus professor of botany of the University of Groningen, president of the sixth International Botanical Congress, at the age of sixty-five years.

THE death is announced at the age of seventy-seven years of Professor Carl Dorno, who founded and directed the Physical Meteorological Observatory at Davos, Switzerland.

SCIENTIFIC EVENTS

GRANTS FOR WAR RESEARCH TO THE UNIVERSITY OF CINCINNATI

CONTRACTS with the United States Government for war research by the University of Cincinnati negotiated during the summer, reported by Dr. Raymond Walters, president of the university, were approved on October 6 by the board of directors of the university.

Ranging from \$2,500 to \$12,000 and amounting in all to \$42,000, these contracts are for investigations now under way in the College of Medicine and the department of leather research of the university for the Office of Scientific Research and Development and in the College of Engineering and Commerce for the Army Air Corps.

In several instances the federal grants were exten-

sions of earlier contracts for the same types of research. In one case, the government allowance was for a six months period and will be renewed for the same amount at the expiration of the current contract.

Nearly $45,000 in gifts and grants were reported. Of these, six, amounting to more than $32,000, were designated to aid the nutritional research being directed in the College of Medicine, under the supervision of Dr. Tom D. Spies, associate professor of medicine. Of the nutrition grants, the largest was for $16,000 from the Williams-Waterman fund for the combat of dietary diseases through the Research Corporation, New York City, to support the work of Dr. Spies for two years. Other nutrition grants included $5,000 from the Gelatin Products Company, Detroit, Mich.; $5,000 from the Anheuser-Busch, Inc., St. Louis; $3,000 from Standard Brands, Inc., New York; $3,000 from the Continental Baking Company, New York, as partial payment of a $10,000 contribution for the year beginning on July 15, 1942; and $50 from Starling W. Childs, Cleveland. Dr. Spies's clinical studies on nutrition are carried on at the Hillman Clinic, Birmingham, Ala.

The W. K. Kellogg Foundation, Battle Creek, Mich., gave $4,000 to establish loan and scholarship funds in the School of Nursing and Health. The same foundation last spring gave $10,000 for similar funds in the College of Medicine.

THE SUPPLY OF TECHNICAL MEN TO THE ARMED FORCES AND TO INDUSTRY

To ensure a continuous flow of young engineers to the armed forces and to industry has been a serious concern to national engineering societies. The supply is already so limited that a contest was developing between the needs of the army, navy, air and signal corps, and the requirements for industrial research, design, production and maintenance.

Facts have been published which showed that a larger number of skilled engineers were required for production and maintenance than was necessary in plant layout. New designs, modernization and war production make demands on the engineering colleges that they provide a steady stream of young engineers for the armed services and industry.

In October, the Engineers' Council for Professional Development called a meeting of industrial personnel and engineering teachers who drew up a statement emphasizing the need for adequate supplies of young technical men.

In November, the American Institute of Chemical Engineers prepared a statement of "significant facts" and strongly recommended:

A. That the loss of technically trained men from war production plants be stopped by cessation of voluntary enlistment or by a "freezing" order covering such personnel and plants.

B. That selective service occupational Bulletin No. 10 of last June be reaffirmed in principle in its provisions for the deferment of men in engineering training.

C. That this directive be modified in the light of the lower draft age by providing for the deferment of engineering students in established colleges to the end of the term in which they reach the age of 18, and thereafter, on a term by term basis as long as their academic records remain satisfactory.

On December 4, the council of the American Society of Mechanical Engineers passed the following:

WHEREAS, technically trained engineers are indispensable to modern mechanized warfare and are needed in greater and greater numbers by the armed forces and by the war industries and will be equally essential to the rehabilitation program,

Therefore, be it resolved that the Council of the American Society of Mechanical Engineers, acting on behalf of the membership of the society, at the sixty-third annual meeting of the society held in New York, November 30th to December 4th, 1942, is convinced that the effective prosecution of the war effort demands that an adequate supply of engineers be insured for the armed forces and the war industries through the deferment of certain students in engineering colleges under the following conditions:

(1) Enrolment in a college with a curriculum professionally accredited by the Engineers' Council for Professional Development.

(2) Completion of not less than one term or one semester's work in an accredited professional curriculum in engineering with an average scholastic grade at least equal to that required for graduation.

This resolution was sent to the President, the Chairman of the War Manpower Commission and the Director of the Selective Service.

On December 8, the Consultative Committee on Engineering for the Professional and Technical Division of the War Manpower Commission adopted unanimously the following:

Recognizing the necessity for a continuing flow of professionally trained men for war industries, especially for urgent developmental work in improving the quality and production of actual weapons and materials of warfare, this Consultative Committee on Engineering for the Professional and Technical Division of the War Manpower Commission respectfully recommends that the Chairman of the War Manpower Commission immediately take the necessary steps in order to provide temporary deferment from military service for those undergraduates in recognized engineering schools who are subject to Selective Service. Such deferment is necessary pending a more thorough study of the requirements of engineering manpower both by war industries and the Armed Forces.

This recommendation confirms and re-emphasizes the resolutions made by the recent annual meetings of the American Society of Mechanical Engineers, the American Institute of Chemical Engineers, the Society for the Promotion of Engineering Education, and others, looking to the deferment of those young men who are already in

engineering training and are maintaining satisfactory academic records. This is not a recommendation for class deferment, but is a recognition of a temporary but critical phase of the manpower situation which requires prompt and decisive action to prevent serious crippling of the war program.

R. L. SACKETT

RARE CHEMICALS

THE following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

1. 2-chloro, 3-nitro-phenoxy acetic acid
2. 2,4-dichloro-alpha-naphthalene
3. 2,4-dichloro-beta-naphthoxyacetic acid
4. Disilicon Hexachloride
5. Quinizarin 6 sulfonic acid
6. Quinizarin boric acid
7. 2-alpha-methyl indole
8. Cyclohexene oxide
9. 2-chloro-cyclohexenone
10. d-ribose-5-phosphoric acid
11. Phospho-erythronic acid
12. Oxalacetic acid
13. Cuprous Benzene Sulfonate
14. Glucose-6-phosphoric acid
15. Phosphopyruvic acid
16. Phosphoglyceric acid
17. Dihydroxyacetone phosphate
18. Creatine phosphate
19. Acetoacetic acid
20. alpha-Ketoglutarate

THE INTER-AMERICAN PROGRAM OF THE AMERICAN STANDARDS ASSOCIATION

TRADE and industrial development of the Americas will be furthered by a program of Inter-American cooperation on industrial and engineering standards which has just been launched by the American Standards Association, according to a statement made by P. G. Agnew, secretary of the association. Such standards are helping government and industry in the United States to speed up production, conserve materials and make substantial savings.

Latin American countries have already shown interest in North American standards and have asked the American Standards Association to supply them with further information.

National standardizing bodies are now in operation in three South American countries. The one in Argentina (Instituto Argentino de Racionalización de Materiales) has been operating a number of years and publishes a monthly magazine. The one in Brazil (Associação Brasileira de Normas Técnicas) has recently issued a volume of standards. The one in Uruguay (Instituto Uruguayo de Normas Técnicas) was formed a short time ago. In other Latin American countries there are government departments and engineering societies doing similar work. Furthermore, there is a South American committee (Comité Sudamericano de Normas) to further standardization work in the ten South American republics.

Cyrus Townsend Brady, Jr., an engineer and sales executive who has spent many years in South America, will serve as the field representative for the American Standards Association. He is being given a year's leave of absence by the U. S. Steel Export Company for the purpose. His work will be supported by an Inter-American Division in the New York office of the American Standards Association, of which Alberto Magno-Rodrigues, who has been for many years in charge of the activities of several American manufacturers of machinery in the Spanish and Portuguese markets, is head.

In the new program the association will exchange technical data in the development and use of standards with the other American republics, give them information on the standardization work being done in the United States, and provide them with Spanish and Portuguese translations of standards which would be especially valuable in developing their industry. It is planned to provide interchange of technical data and information to enable all the countries of the Western Hemisphere to have standards as much alike as possible.

An advisory committee has been appointed under the chairmanship of R. E. Zimmerman, president of the association and vice-president of the U. S. Steel Corporation.

FELLOWSHIPS IN THE MEDICAL SCIENCES OF THE NATIONAL RESEARCH COUNCIL

FELLOWSHIPS in the medical sciences, similar to those which have been administered by the Medical Fellowship Board of the National Research Council since 1922, will again be available for the year beginning on July 1, 1943. These fellowships, supported by grants from the Rockefeller Foundation to the National Research Council, are designed to provide opportunities for training and experience in research in all branches of medical science. They are open to citizens of the United States or Canada who possess the degree of M.D. or Ph.D., and are intended for recent graduates who are not yet professionally established.

In addition to these fellowships the board administers two groups of research fellowships, made available through a grant from the National Foundation for Infantile Paralysis, Inc. The first group, open to applicants who hold either the Ph.D. or M.D. degree, is for the purpose of providing opportunities for special training and experience in the study of filtrable

viruses. The second group, open only to graduates in medicine who have completed one or more years of hospital experience in clinical surgery and are planning a career in orthopedic surgery, is designed to provide opportunities for training and research in those basic medical sciences which will be of particular value in furthering progress in the field of orthopedic surgery.

Fellows will be appointed at a meeting of the board late in February. Applications to receive consideration at this meeting must be filed on or before January 1. Appointments may begin on any date determined by the board.

For further particulars concerning these fellowships, application should be made to the Secretary of the Medical Fellowship Board, National Research Council, 2101 Constitution Avenue, Washington, D. C.

SCIENTIFIC NOTES AND NEWS

The *Times*, London, reports that the King of England has approved the recommendations of the Council of the Royal Society awarding royal medals for 1942 to Professor W. N. Haworth, F.R.S., for his fundamental contributions to organic chemistry, particularly to the constitution of the sugars and the structure of complex polysaccharides, and to Dr. W. W. C. Topley, F.R.S., for his outstanding work on experimental epidemiology and immunology. Awards of medals by the president and council of the society are: the *Copley Medal* to Sir Robert Robinson, F.R.S., for research work of outstanding originality and brilliance which has influenced the whole field of organic chemistry; the *Rumford Medal* to Dr. G. M. B. Dobson, F.R.S., for his outstanding work on the physics of the upper air and its application to meteorology; the *Davy Medal* to Professor C. N. Hinshelwood, F.R.S., for his distinguished work on the mechanism of chemical reactions; the *Darwin Medal* to Professor D. M. S. Watson, F.R.S., for his researches on primitive fishes and amphibians which have much advanced the knowledge of the evolution of these groups of animals; the *Buchanan Medal* to Sir Wilson Jameson, for his distinguished administrative service to hygienic science and practice; the *Hughes Medal* to Professor Enrico Fermi, for his outstanding contributions to the knowledge of the electrical structure of matter, his work in quantum theory and his experimental studies of the neutron.

Josiah K. Lilly, chairman of the board of Eli Lilly and Company, was presented with the Remington Honor Medal for 1942 "for his many accomplishments in the interests of pharmacy" at a dinner given on December 2 by the local branch of the American Pharmaceutical Association in New York City.

Dr. Harry N. Holmes, professor of chemistry and head of the department at Oberlin College, president of the American Chemical Society, has been elected an honorary member of the Chemical, Metallurgical and Mining Society of South Africa.

It is reported in *Nature* that the Emil von Behring Prize, which is awarded by the University of Marburg every two years for outstanding achievements in immunology, serum therapy and chemotherapy, has been presented to Professor Paul Uhlenhuth, professor of hygiene and bacteriology at the University of Freiburg-im-Breisgau.

At the seventh annual meeting of the Florida Academy of Science held at the University of Florida, Gainesville, on November 20 and 21, the following officers were elected for 1943: *President*, Robert B. Campbell, Tampa; *Vice-president*, T. H. Hubbell, University of Florida; *Secretary-Treasurer*, R. F. Bellamy, Florida State College for Women.

Dr. John Boswell Whitehead, director of the School of Engineering of the Johns Hopkins University, has become professor emeritus.

Dr. William M. Smallwood, head of the department of zoology at Syracuse University, will have leave of absence during the second semester prior to his official retirement in June. He has been a member of the faculty for forty-six years.

Dr. Rheinart Parker Cowles, professor of zoology at the Johns Hopkins University and for the past twelve years investigator in charge of the biological and hydrographical survey of the Chesapeake Bay, retired in September.

Dr. Lee Bonar has been appointed chairman of the department of botany of the University of California at Berkeley. He succeeds Alva R. Davis, who is now a major in the Coast Artillery at Camp Callan, San Diego. Dr. Bonar has been associated with the university for the past twenty years.

The chair of oil engineering and refining in the University of Birmingham, vacant by the death of Professor A. W. Nash, has been filled by the appointment of Dr. F. H. Garner, a graduate of the university. Dr. Garner was for many years chief chemist of the Anglo-American Oil Company.

Dr. Harold P. Brown, chairman of the department of chemistry of the University of Kansas City, has joined the staff of the Synthetic Rubber Division

of the Research Laboratories of the B. F. Goodrich Rubber Company, Akron, Ohio.

DR. CHARLES A. COOK, formerly senior biochemist at the Experimental Research Laboratories of Burroughs Wellcome and Company (U.S.A.), Inc., is now in charge of the department of medical and biological chemistry at the Research Laboratories of the Lambert Pharmacal Company in St. Louis.

Chemical and Engineering News states that Wilmer T. Rinehart, who was recently associated with the United States Gypsum Co. and formerly with the Roessler and Hasslacher Chemical Co. at Niagara Falls, N. Y., has joined the chemical engineering staff of the Armour Research Foundation.

THE three hundred and fifteenth meeting of the Washington Academy of Sciences was held jointly with the Anthropological Society of Washington on December 17. Matthew W. Stirling, chief of the Bureau of American Ethnology of the Smithsonian Institution, delivered an address entitled "Anthropological Explorations in Netherlands New Guinea."

DR. HARLAN TRUE STETSON, of the Massachusetts Institute of Technology, addressed the Worcester Polytechnic Institute Chapter of the Society of Sigma Xi on the occasion of the initiation of new members on December 4. He spoke on "Solar Radiation and the Upper Atmosphere."

PETER E. KRAGHT, senior meteorologist of the American Airlines, Inc., gave on December 1 a public lecture on "Meteorology and Our Daily Work" before the Kappa Chapter of Sigma Xi of Columbia University.

DR. ERNEST SACHS, professor of neurological surgery at Washington University Medical School, St. Louis, delivered the William Haggard Memorial lecture at Vanderbilt University on November 27. The subject was "The Essential Qualifications of a Great Surgeon."

JOHN LOVELL LOUGHBOROUGH, a member of the Industrial Relations Research Department of Lockheed and Vega Aircraft Corporations, has been appointed consulting anthropologist to the Advisory Council of the California State Bureau of Industrial Health. The council will advise on problems dealing with war and post-war industrial health problems.

THE American Mathematical Society and the Mathematical Association of America have voted to cancel the New York meeting, in line with the postponement of the annual meeting of the American Association for the Advancement of Science. The meetings were to have been held during Christmas week in conjunction with the association.

THE meeting and symposium which had been arranged by the American Association of Physical Anthropologists to be held jointly with Section H of the American Association for the Advancement of Science have been cancelled.

THE annual meeting of the Society of American Bacteriologists has been cancelled. It was planned to be held in Columbus, Ohio, on December 28, 29 and 30.

BY vote of the executive committee of the American Association of Anatomists, the meeting scheduled for Montreal in April, 1943, has been postponed.

THE American Statistical Association has cancelled its annual meeting, which it was planned to hold in Cleveland from December 29 to 31, because of the greatly increased need for curtailment of civilian travel resulting from the acceleration of war activities and the probability that government employees planning to participate in the program would not be granted leave for this purpose. The other societies composing the group of Allied Social Science Associations have also cancelled their Cleveland meetings. Arrangements are now being made for the presentation of a number of the papers scheduled for the annual meeting at special meetings of the Washington and New York Chapters of the association.

IT is reported in the daily press that a national committee to aid the war effort, none of whose members will go to Washington, is being organized. Members will consult individually with War Production Board representatives by telephone and letter only, and will not be asked to meet in Washington. The referee board of the chemicals division, through its chairman, Professor Donald B. Keyes, of the University of Illinois, stated that the group will be made up of leaders in research and development in the chemical and allied industries. They will serve as liaison men between their companies or industries and the referee board.

WHEN Dr. J. Shelton Horsley was president of the Virgnia Academy of Science in 1926, he raised an endowment fund amounting to $12,000, interest from which has been used since to aid and encourage younger men and women in Virginia with aptitudes for scientific investigative work. This year's research committee of the academy consists of Dr. Harvey B. Haag, *chairman*, Dr. Allen T. Gwathmey, J. H. Johnson, Dr. Gillie A. Larew, Dr. Ivey F. Lewis, Dr. Rolland J. Main and Dr. Frank C. Vilbrandt. Dr. E. C. L. Miller, secretary, and Dr. Sidney S. Negus are ex-officio members. At a recent meeting of this committee research grants were awarded to the following: Dr. Lynn D. F. Abbott, Medical College of Virginia; Professor J. A. Addlestone and Herman Hackerman,

Virginia Polytechnic Institute; W. L. Gooch, of the Chesapeake Corporation; James McD. Grayson, Virginia Polytechnic Institute; Dr. Ladley Husted, University of Virginia; Claiborne S. Jones, University of Virginia, and Dr. C. R. Spealman, Medical College of Virginia.

BECAUSE of the demand for women in certain kinds of engineering work, the Drexel Institute of Technology, Philadelphia, will accept in February women students in all departments of the School of Engineering. The Drexel Evening Diploma School opened new engineering classes on the evening of December 14 for women as well as men. The subjects offered are mathematics, algebra, geometry, trigonometry, analytical geometry and calculus, physics, inorganic chemistry, mechanical and engineering drawing, the foundations of English and advanced English. Students may enroll for one, two or three evenings a week.

A PRE-METEOROLOGICAL training course covering six months of intensive instruction in physics, mathematics and electrical engineering will be opened on March 1 at the University of Michigan. Four hundred privates from the Army are expected to be in attendance.

APPLICATIONS must be received by March 1 for the Mary Putnam Jacobi Fellowship for Medical Research of $1,000 of the Women's Medical Association. Blanks may be obtained from the secretary of the committee, Dr. Phebe L. Du Bois, 150 East 73rd Street, New York.

THE board of the second Sigma Delta Epsilon Fellowship has announced that applications and reference statements, both in triplicate, for the 1943–1944 award of $1,000 should be submitted to it before March 1. Women with the equivalent of a master's degree, conducting research in the mathematical, physical or biological sciences, who need financial assistance to complete their work for the doctorate, and give evidence of high ability and promise, are eligible. The appointee must devote the major part of her time to an approved research project, and not engage in other work for remuneration unless such work shall have received the written approval of the board before the awarding of the fellowship or in any later emergency. Application blanks may be secured from Dr. Eloise Gerry, care of the U. S. Forest Products Laboratory, Madison, Wisc. Announcement of the award will be made early in April.

PRINCETON UNIVERSITY has received a legacy by the will of Louise R. Pierson, of Orange, N. J., of $25,000 for the endowment of a sixth scholarship in memory of the late Dr. John Grier Hibben, the fourteenth president of the university. The fund will provide annually a scholarship "for a New Jersey man of outstanding scholarship, character and promise . . . who intends to make the practice of medicine his life profession."

THE James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, offers $5,000 in student awards and $1,750 in scholarships for the departments of the institutions in which the students are registered. There are seventy-seven student awards—a first award of $1,000, a second of $500, a third of $250, four awards of $150, eight of $100, twelve of $50 and fifty of $25. There are seven scholarships of $250 each. The school of the winner of the first award will receive four scholarships; of the second two, and of the third one. Any resident engineering undergraduate student registered in any school, college or university in the United States, giving a course in any branch of engineering or architecture, leading to a degree, or any cadet registered in the U. S. Military Academy, U. S. Naval Academy and the Coast Guard Academy is eligible to submit a paper. The awards will be made for papers describing the conversion from other methods to arc-welded construction of parts of machines, complete machines, trusses, girders or structural parts.

THE Museum of Vertebrate Zoology of the University of California at Berkeley has recently completed the identification of birds obtained in El Salvador, Central America, in the early part of 1942. The collection, numbering 1,145 items, was made by Joe T. Marshall, Jr., assisted principally by John Davis, while they were members of the University of California's expedition to El Salvador under the direction of Dr. R. A. Stirton. The material comprises 301 separate species and subspecies. Of these 217 are new to the collection and 47 genera are for the first time represented there. One of the most valuable aspects of this collection is its inclusion of 345 complete bird skeletons of 192 species. These afford material for extensive study of the phyletic relationships of groups of Neotropical birds; skeletons of many of these species are either rare or lacking in North American and European institutions.

BIRDS, small mammal specimens, pressed plants, insects, rocks and minerals, seeds, soils, American Indian handicraft objects and other natural history and ethnological material may now be drawn from Field Museum of Natural History as are books from a public library. This is a new service inaugurated by the N. W. Harris Public School Extension Department. The new materials have been made available to provide teachers with visual aids that can be used at times when instruction in a particular subject is

being given in classrooms as part of the regular curriculum. Most of the specimens are of natural history subjects local to the Chicago area. Teachers may obtain loans of this material upon written or telephoned request, to the extent that previous loans make compliance with their requests possible.

ACCORDING to *The Experiment Station Record*, an Agricultural Machinery Development Board set up early in 1942 has established a National Institute of Agricultural Engineering at Askham Bryan, near York. The nucleus of the institute is the Institute of Research in Agricultural Engineering, transferred from Oxford by the university with its director, S. J. Wright, continuing in charge. Temporary housing in the new location will be provided in buildings belonging to the Yorkshire Council for Agricultural Education, but eventually it is intended to build permanently on a near-by site. The main functions of the new institute will be to act as a general clearing house for information about agricultural machinery and its use, to carry out tests or demonstrations of new or improved implements and to undertake experimental and demonstration work on the better utilization of existing equipment.

DISCUSSION

PREDETERMINATION OF SEX[1]

IN the past the sex of the offspring from any mating has been a matter of chance. Despite the fact that thousands of techniques have been suggested no method of sex control has stood the scrutiny of unbiased investigation.

The advent of this century contributed a major advance in understanding the mechanism behind this chance distribution of the sexes. The unbalanced condition of one or more chromosome pairs in one sex furnished the mechanism whereby the distribution of sex in a population was random with a mean approximating equality for the two sexes. The extension of the gene balance concept to our knowledge of sex determination did not alter the random nature of the sex distribution, it refined our understanding of how the randomness came about. No man-controlled environmental circumstance was found to affect the ratios of the gametes or the sex after their fusion.

Sex-linked lethals gave students of inheritance the first positive means of controlling the sex of specified progeny. The control was directional in that it reduced the numbers of males. But it was positive and could be duplicated to any interested person's satisfaction. At first this genetic control changed the sex ratio from the 50:50 distribution to 33⅓ males to 66⅔ females. But the introduction of one or more lethal genes in each of the sex chromosomes with prevention of crossing over soon showed that the sex control could be made practically perfect, no males to 100 per cent. adult females. This directional genetic control of the adult sex ratio had become an accomplished fact.

Gowen and Gowen[2] demonstrated another genetic control of sex. The presence of a homozygous gene pair in the third chromosome of *Drosophila melanogaster* controlled the embryological development of the sex-differentiating organs. Besides normal males and females, individuals with a mixture of male and female organs appeared in the progeny. Inheritance control of sex even to the organ arrangement was evidently a function of this gene. But the path over which the gene worked was also learned. The gene controlled the maturation division of the parent female in such a manner that diploid and fractionally diploid eggs, instead of the haploid eggs, were produced.

Gershenson[3] in *Drosophila obscura* analyzed another case in which the genotype affects the maturation division. In this case the male instead of the female is the responsible agent. Male genotypes carrying this inheritance in their sex chromosomes have nearly 100 per cent. female progeny (96 per cent. females to 4 per cent. males) without regard to the females to which they are bred. The possible mechanism through which this inheritance may work has been further clarified by Sturtevant's and Dobzhansky's[4] observation that at maturation of this genotype the sex chromosome undergoes equational division at each meiotic division, the Y degenerates and the autosomes behave normally.

These cases furnish understandable mechanisms for shifting a normal sex ratio of 1 male to 1 female to that of all females. The other end of the sex control question, the production of all male progeny, has not been possible as yet. It is the purpose of this paper to present such a case where genotypic control leads to a progeny of 100 per cent. males.

In crosses intended for homozygosis studies, Mr. Nelson observed a pair mating of *Drosophila melanogaster* which produced 136 males and no females. The male progeny of this cross were able to transmit

[1] Journal Paper No. J-1054 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. 714.

[2] Marie S. Gowen and John W. Gowen, *Am. Nat.*, 56: 286–288, 1922; John W. Gowen, SCIENCE, 68: 211–212, 1928; John W. Gowen, *Am. Nat.*, 65: 193–213, 1931.

[3] S. Gershenson, *Genetics*, 13: 488–507, 1928.

[4] A. H. Sturtevant and Th. Dobzhansky, *Genetics*, 21: 473–490, 1936; A. H. Sturtevant, *Proc. Nat. Acad. Sci.*, 23: 360–362, 1937.

the male-producing characteristic to certain of their daughters without regard to the characteristics of the mates to which they were bred. In something over 500 matings, covering a period of 8 generations from the original parent, no failures in finding the expected male-producing genotype have occurred.

The daughters with the genotype for all male progeny produce all male offspring without regard to the mates with which they are bred. The males give no phenotypic expression of this inheritance. The male-producing genotype is thus without effect on the adult males which carry it. The inheritance is sex-limited in its action in that it affects only the females which have it, acting as a dominant.

This case completes the span for the genetic control of sex. Genotypes, which may be genetically controlled, have now been established for the most divergent sex ratios possible, 100 per cent. female in one progeny and 100 per cent. male in the other. Many problems of sex differentiation and distribution are, of course, left, but in the sense of establishing means for sex control through specific agencies under man's guidance, the problem of the predetermination of sex may be said to be solved.

JOHN W. GOWEN
RONALD H. NELSON

PEDIGREED PINE FOR NAVAL STORES PRODUCTION

IN the fall of 1941 the U. S. Forest Service started a project concerned with the development of an extra-high-yielding strain of naval stores pine. Efforts were directed toward the selection of naturally superior individuals and the working out of methods for their propagation. The undertaking has precedent in the notable success achieved with other tree species yielding special products. It is well known, for example, that the average output of rubber latex from *Hevea* has been greatly increased as a result of careful selection, controlled breeding and the propagation of superior clones. High-yielding strains of *Cinchona*, from which quinine is obtained, were similarly developed.

The naval stores belt was thoroughly scouted for outstanding trees—trees which for no apparent reason produced exceptional yields of oleoresin. Emphasis was placed on slash pine (*Pinus caribaea* Morel.), since this species normally yields more gum than longleaf pine (*P. palustris* Mill.), the other commercially important producer of naval stores. Of the thousands of trees inspected, twelve of the most promising were selected for further study. During the summer of 1942 the yields of these trees were accurately determined by weighing the gum produced each week. In connection with each of the twelve, equally precise data were also obtained on the yields of from fifteen to fifty control trees of the same species, age, size, growth rate and general appearance growing under similar conditions on the same site. Comparisons made near the end of the season show that the majority of the trees under test produced from two to three times as much gum as the average of their respective control groups. Because of the care used in selecting and checking the test trees, it is probable that the superiority of at least some of them is due largely to hereditary factors. In the meantime, the search continues for additional outstanding individuals.

Vegetative propagation was chosen as the most promising method for speeding up the production of planting stock having the same characteristics as the superior trees selected in the present study. The advantages and possibilities of this method and its importance in the field of forest tree genetics have been discussed by Schreiner.[1] Research in vegetative propagation, directed chiefly toward the rooting of cuttings, was started in November, 1941. Cuttings from young slash pine were used exclusively in the initial exploratory experiments. It was soon found that with proper treatment, better than 90 per cent. of this material could be rooted within five weeks from the time of planting.[2] Work was then started on cuttings from older trees, large enough to work commercially, and for which gum yield records were available. This type of material proved much more difficult to root. Thousands of cuttings from mature trees, collected at 15-day intervals, were tested during the winter, spring and summer of 1942. The material was cut and handled in different ways, given a total of 175 chemical treatments, and planted in 40 different environments provided in greenhouse and nursery. Results with the winter and spring collections were discouraging; none rooted or even calloused, and all eventually died. The first successful rooting of cuttings from mature slash pine was observed on August 19 for material collected and planted on June 20.

To date, roots have been observed only on cuttings given rather complex chemical treatments. The two most promising treatments seem to be: (1) a 24-hour treatment in a solution containing 50 ppm traumatic acid,[3] 10 ppm vitamin B_1, all essential mineral elements and 5 per cent. sugar, followed by a dust treatment with commercial Hormodin No. 2 just previous to planting; and (2) a 24-hour treatment in a solution

[1] E. J. Schreiner, *Jour. For.*, 37: 1, 61–62, 1939.

[2] H. L. Mitchell, *Naval Stores Review*, 52: 7, 10–12, 1942.

[3] Traumatic acid has been tentatively identified as 1 decene – 1, 10, dicarboxylic acid (J. English, J. Bonner and A. J. Haagen-Smit, SCIENCE, 90: 2336, 329, 1939). That used in these experiments was made available through the courtesy of Merck and Company.

containing 25 ppm indolebutyric acid, 12 ppm indoleacetic acid, 12 ppm naphthaleneacetic acid, 10 ppm vitamin B_1, all essential mineral elements and 5 per cent. sugar. The most favorable environment, according to present information, is as follows: well-drained sand as the rooting medium, full sunlight in nursery, high humidity, temperatures between 75° and 90° F., and cuttings exposed to fine spray of water (from atomizing nozzles mounted above the beds), with spray on either continuously or for 5 minutes out of each 10-minute cycle for from 10 to 12 hours each day. The spray system used is an adaptation of the spray chamber technique described by Raines.[4]

All research in propagation is being pointed toward the development of effective vegetative techniques sufficiently simple for large-scale use under nursery conditions. If successful, it is possible that certified high-yielding planting stock will be produced in public nurseries and offered for sale to land owners at or below cost. When one considers the rate at which trees grow in the naval stores belt, and that normally over 100 million trees are planted annually in the Southeast, the possibilities of this undertaking become more apparent. It is reasonable to believe that the development of high-yielding stands would contribute greatly to the solution of production problems which have long troubled the $25,000,000 a year naval stores industry, which supports some 50,000 workers and their dependents. Yield increases of 200 per cent. or more seem possible of attainment. By thus increasing the average output per tree it should be possible to reduce production costs sufficiently to meet low prices and competition from synthetics, and at the same time allow good wages for labor and an adequate profit for the producer.

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A NEED FOR MORE UNIFORM USAGE OF WORDS OF INDEFINITE MEANING

IN science it is our practice to observe, accurately measure and record and, accordingly, we are ever faced with the necessity of posing mathematical relationships. Despite the vast and rapid accumulation of recorded data which makes up the body of our respective sciences, it is nevertheless true that the greater part of our knowledge as individuals consists of a memory of casually observed phenomena which we have not yet taken the time to analyze, accurately measure or record. Thus in our general discussions we are obliged to make use of words of indefinite meanings, such as "few," "some," "very," "many," "much," "most," "frequent," "slightly" and "seldom."

During a discussion with a group of scientific friends I was interested to note that there was no agreement among them as to the relative significance of these words. If to each mind they conveyed differing impressions, these words are not as efficient as they might be as vehicles for our thoughts. It has occurred to me that as these words are such useful tools, it would be a worth-while project to attempt to increase their usefulness by more narrowly restricting their meanings and by securing a more uniform usage.

As a preliminary step I have tabulated the impression some of these words convey to me. I have expressed them in terms of approximate percentage spread of the relative frequence or intensity they indicate to me. Obviously their meanings must indicate approximations, for they indicate frequencies we do not know. In each case also their meanings will vary with the nature of the subject of discussion, but in each case the percentage noted is in relation to a maximum applicable to the particular case. I do not expect acceptance of any of my figures, but it would be of great interest to learn how great will be the variance shown by our readers.

TABLE 1

Per cent. frequency indicated		Per cent. frequency indicated	
1, 2	very few, seldom	60, 70	
3, 4, 5	few, some, slightly	80, 90, 95	most
10, 15, 20, 25	many, much, frequent	98, 99	practically all
		100	all
30, 40	very many		
45, 50, 55	about half average (in general sense)		

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RAHWAY, N. J.

SCIENTIFIC BOOKS

FOREST TREE SEED

Forest Tree Seed. By HENRY IVES BALDWIN. The Chronica Botanica Company, Waltham, Massachusetts, and G. E. Stechert and Company, New York, N. Y. $4.75.

THE great conservation programs that our country had under way during the middle and late 1930's re-

[4] M. A. Raines, *Am. Jour. Bot.*, 27: 10, 18, 1940.

quired vast quantities of forest tree seeds. Pines, spruces, larches, redwood and Douglas fir were planted for timber; oaks, hickories, ashes, walnut and yellow poplar to stabilize eroding farmland; hackberry, Osage orange, mulberry and green ash for shelterbelts; locusts for road banks; wild cherries and plums for game food; and many ornamentals for landscaping. For all purposes, it is estimated that the United States used annually during the late 1930's some three million pounds of forest seed, costing in the neighborhood of $1,500,000. Species used or considered for use total almost 700 for the country as a whole. In addition, prior to the war our country enjoyed a relatively vigorous export trade in tree seed, and at various times in the past has imported important quantities from Europe.

In contrast to most agricultural seed, forest tree seeds are notoriously difficult to handle. Many species bear usable seed crops irregularly, and often these are destroyed by seed-eating birds and rodents that congregate in extraordinary numbers at the time seed is shed. The fruits or cones must be harvested from tall trees or diligently searched for in well-secluded squirrel caches. Extraction techniques are involved and great care must be taken not to injure the delicate seed in the process. Unless the seed is stored under optimum moisture and temperature conditions, viability is limited in many cases to a few days' or a few weeks' time. Germination after sowing is often irregular and frequently delayed for at least a full year while seed coats disintegrate and the embryos after-ripen.

The study of tree seed cuts across the fields of genetics, embryology, histology, morphology, physiology and biochemistry on the one hand, phenology, bioclimatics, ecology, pathology, parasitology and entomology on the other. An authoritative book on tree seed is therefore both a welcome addition to plant science literature and a much-needed reference book for the many men who are engaged directly or indirectly in the use of tree seed for forest, ornamental or other planting. The preparation of such a book was an ambitious undertaking. It is fortunate that the author is widely experienced in forest research and thoroughly familiar from first-hand knowledge with a large number of tree seeds and with the techniques developed in the important American and European seed laboratories.

The first seven chapters of the book present information that the seed collector and seed dealer require, but with a broad enough background to interest students as well. Here is included the general description of seed, their life histories, their physical and chemical structure and their various economic uses. Collectors will be particularly interested in the discussion of periodicity of bearing, forecasting of seed crops and the natural distribution of seed. The seed user needs to know how many desirable hereditary characteristics are related to the geographic origin of the seed. This subject, widely studied in Europe, is receiving increasing attention in the United States by both agriculturists and foresters. However, only a few American species have been tested experimentally to determine the extent to which they contain racial differences dependent on the climate and soils of their native habitats.

Baldwin has done an excellent job in covering the collection, extraction and storage of coniferous seed. The treatment of these subjects includes both a historical résumé and the latest modern technique. Such treatment is highly desirable, inasmuch as we can find in America to-day all stages of crudity and refinement in the collection, extraction and storage of tree seed. Modern techniques of extracting seed from cones have been based on thorough experience in the artificial drying of lumber. As a result, it is now possible to use high kiln temperatures, low humidities and short extracting times, thereby recovering seed of high viability and containing the proper moisture content for storage.

The entire second part of the book is devoted to seed germination and seed testing. The fascinating interrelationships between forest seed and their natural environment, especially their mode of dispersal, storage and germination under natural conditions, unfold a field of ecology, the many ramifications of which are at present only dimly surmised. Baldwin describes clearly the many causes of dormancy and touches briefly on the utility of dormancy mechanisms in protecting the seed against loss through premature germination. The influence of external factors on germination and the chemistry of germination are both adequately handled in view of current information on these subjects. The author goes into minute detail in discussing the techniques used in seed testing and purity analyses by seed laboratories in our own country and foreign laboratories operating under the international rules for seed testing. The chapter dealing with the determination of origin by laboratory means describes a number of techniques that have been proposed, but does not point out adequately the difficulties involved in their use. Techniques that have proven more successful in determining the origin of agricultural seed, such as weed seed content, the reaction of the seedlings to various lengths of day and various physiological tests, are passed over largely because these have not yet been adapted successfully to tree seed analysis.

To the uninitiated reader it may appear that Baldwin's treatment of many subjects is hurried or super-

ficial, even though the book does contain an impressive bibliography of more than 800 citations. Actually, such an accusation has little justification. A truly exhaustive search of the literature has been made, and relatively few important omissions will be uncovered even by the specialist in the field. Suggestions for improvement can, of course, be made. For instance, the text bears signs of important omissions of data and condensations of treatment that rob it of much of the richness possible to include in a larger volume. Little space is devoted to methods of collecting, cleaning and storing the seeds of hardwoods that recently have come into wide use for shelterbelt, erosion and game food planting. It is true that little has been published on hardwood seeds even though much is known. Readers particularly interested in hardwoods will find a more complete treatment in the recent nursery handbook prepared by Engstrom and Stoeckeler.[1] The discussion of periodicity of seed production could have been strengthened materially by drawing upon horticultural literature on irregular bearing of apples and other fruits. Important studies of wind dissemination by Hesselman and others merit mention. The present status and future needs in the field of tree seed research are inadequately set forth. However, throughout the several chapters suggestions for valuable research will occur to the imaginative reader. Other subjects that might have been more completely developed for the American reader include the life history of seed, provenance and the behavior of seed in their natural environment. The Swedish and German explanations on maps and diagrams shown in the text should have been translated for American readers. The book does not bring together the status of knowledge on individual species. A manual covering this subject is now under preparation by the U. S. Forest Service.

On the whole, however, the book is scholarly, readable and informative. It fills a long-felt need. Not the least of its valuable contents is the 16-page glossary of tree seed terminology that immeasurably increases its utility. It is hoped that this book will help to open the field for intensive study during the coming years.

Hardy L. Shirley

Allegheny Forest Experiment Station

[1] H. E. Engstrom and J. H. Stoeckeler. 1941. Nursery Practice for Trees and Shrubs. USDA Misc. Publ. 434.

SPECIAL ARTICLES

CROSS-CIRCULATION AS A METHOD IN THE STUDY OF DRUG FIXATION AND POISONING

In the endeavor to study the mode of the vagoparalytic action of amytal, two cross-circulation experiments were performed in which one animal received amytal and the other paraldehyde; the latter does not paralyze the vagus. Both drugs were given one hour previous to the beginning of cross-circulation. It was believed that if amytal did not prevent the formation of acetylcholine the partner under paraldehyde anesthesia might show cardiac inhibition and fall of blood pressure following the stimulation of the vagus of the amytalized animal. The results were disappointing, however, because before the beginning of cross-circulation the vagus of the amytalized animal was paralyzed and the vagus of the other animal was not, whereas during the progress of the cross-circulation the vagus of the amytalized partner became more responsive and the vagus of the other partner less and less responsive to faradic stimulation. This substantiated the original assumption of the authors[1] that fixed anesthetics do not actually remain permanently fixed in the tissues.

It was decided to study this problem further by administering 250 mg of barbital sodium per kgm of body weight to five dogs intravenously and wait for about 2 hours until the barbital action was at its maximum. Then each of these dogs was united with an etherized partner weighing almost three times as much and cross-circulation was begun.

The pairs of dogs used in these experiments were given 2,000 Roche Inhibitor Units of heparin (Roche) per kgm. Then the left carotid artery of the first dog was connected with the right external jugular vein of the second dog, and the right carotid artery of the second dog was connected with the left external jugular vein of the first dog. This operation was carried out by tying off the cephalic end of each vessel in the neck and inserting the ends of the U-connecting cannulae into each vessel caudally. Each of the small U-cannulae was filled with normal saline and all air expelled before the ends of the cannulae were tied in place. The bull-dog clamps were removed from both carotid arteries simultaneously when cross-circulation was begun.

The cross-circulation lasted for an hour, using ether whenever necessary for tranquilization, and after this period the partners were separated from each other and their wounds closed. The dogs receiving 250 mg of barbital sodium recovered[2] in an average time of

[1] Dille, Linegar and Koppanyi, *Jour. Pharmacol.*, 55: 46, 1935.

[2] Recovery-animals can stand without support. These animals were in about the same state as those receiving 50 to 70 mg of barbital sodium per kgm.

27 minutes, whereas six control dogs receiving the same dose of barbital sodium, but not cross-circulated, recovered in an average time of 29 hours.

Two dogs received 500 mg of sodium barbital per kgm of body weight and following the period of one to two hours were similarly cross-circulated to etherized partners, the pairs being of approximately equal weights. After an hour the partners were separated and both survived and were asleep for over 24 hours. Six dogs were given 500 mg of sodium barbital and they all died; the survival periods for five dogs were 127 to 235 minutes and one died in 45 minutes.

These experiments substantiate the original thesis of Koppanyi concerning the establishment of dynamic equilibrium of barbiturates in the body and show that they are not fixed in the tissues and that they may be mobilized at any time. This method of cross-circulation is proposed to study the fixation or alleged fixation of drugs, the criterions varying, of course, from drug to drug. Opiates and digitalis principles would seem to offer a particularly fruitful field for this line of study. The authors believe that few drugs if any will not be removed by cross-circulation.

The cross-circulation obviously is a method which has given excellent results in the treatment of experimental barbiturate poisoning and probably an apparatus could be constructed to provide for slow, continuous bleeding of the poisoned individuals and to replace the drawn blood at the same rate with normal plasma or compatible whole blood.

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THE ACTION OF SULFANILAMIDE COMPOUNDS ON THE LETHAL FACTOR OF BACTERIAL TOXINS

IN most gram negative bacteria the toxic factor appears to form a part of the complex O antigen,[1] and although earlier work suggested that the antigenic, and presumably the toxic portion of the endotoxin was associated with its "polypeptide" component, more recent studies[2] indicate that this component is a protein. Our studies[3] of the property which such bacterial products have of inducing hemorrhage[4] in implanted mouse tumors led to an investigation of the mode of detoxication of these antigens when introduced parenterally.

While it is generally assumed that the action of sulfanilamide compounds is one of bacteriostasis ensuing from interference with the utilization of *p*-aminobenzoic acid, our results confirm previous findings,[5,6] that sulfanilamide also markedly increases the resistance of mice to certain preformed bacterial toxins.

The toxin used in this study was prepared by growing *Salmonella typhimurium* in a medium containing citrate and dextrose as sole organic constituents. The profuse growth was killed with 2 per cent. phenol, and the suspension transferred to regenerated cellulose tubing. The contents of the tubes were simultaneously dialyzed against water and reduced to a small volume by pervaporation in a current of warm air. The phenol-free toxin was precipitated in 80 per cent. acetone, the precipitate dried with alcohol and ether, and then taken up again in water. Injected intraperitoneally into male mice weighing 20 g, 1.3 mgm of this preparation killed 50 per cent. of the animals within twenty-four hours. This amount of toxin was therefore designated as one minimum lethal dose. It was found that 2.0 MLD killed 92 per cent. of the mice, and 10.0 and 20.0 MLD killed 100 per cent.

Compounds assayed for protective effects were administered in neutral aqueous suspension by stomach tube to mice receiving simultaneously an intraperitoneal dose of toxin. In Table 1 it is seen that sulfanilamide affords almost complete protection from 2.0 MLD of the toxin, and 33 per cent. of the mice survived 10.0 MLD. Sulfathiazole and sulfapyridine were somewhat less effective. Also, if sulfanilamide is administered one hour before the toxin is injected and is followed by supplementary doses of sulfanilamide, the degree of protection against the toxin is somewhat increased.

Animals receiving toxin together with adequately protective amounts of sulfanilamide were subcutaneously given small amounts of *p*-aminobenzoic acid. As seen in the table, the effect of *p*-aminobenzoic acid in reducing the action of the sulfanilamide and thus allowing the toxin to exert its lethal effect was quite striking, and suggests that sulfanilamide and *p*-aminobenzoic acid compete for the enzymes concerned in the detoxication effect in a manner comparable to that described for bacteriostasis.

[1] A. Boivin, *Rev. d'Immun.*, 6: 86–115, 1940.

[2] W. T. J. Morgan and S. M. Partridge, *Biochem. Jour.*, 35: 1140–63, 1941.

[3] P. A. Zahl, S. H. Hutner, S. Spitz, K. Sigiura and F. S. Cooper, *Am. Jour. Hyg.*, 36: 224–42, 1942.

[4] Experiments in progress indicate a protective action by sulfa drugs against the hemorrhage inducing effects of this antigen.

[5] C. M. Carpenter, P. L. Hawley and G. M. Barbour, SCIENCE, 88: 530–1, 1938; C. M. Carpenter and G. M. Barbour, *Proc. Soc. Exp. Biol. and Med.*, 41: 255–9, 1939; C. M. Carpenter, *Proc. Soc. Exp. Biol. and Med.*, 41: 354–7, 1939.

[6] C. Levaditi and A. Vaisman, *C. R. Soc. Biol.*, 128: 463–5; C. Levaditi, A. Vaisman and L. Reinié, *Ann. Inst. Pasteur*, 61: 635–61, 1938.

TABLE 1

Toxin	Sulfanilamide	*p*-amino-benzoic acid	Per cent. survival	No. of animals
1 M.L.D.	....	.....	52	48
2 M.L.D.	....	.....	8	36
10 M.L.D.	....	.....	0	38
.....	20 mgm (oral)	.....	95	20
2 M.L.D.	20 mgm (subc.)	.....	46	13
2 M.L.D.	20 mgm (oral)	.....	94	38
10 M.L.D.	20 mgm (oral)	.....	33	30
10 M.L.D.	20 mgm one hour prior to toxin injection plus two doses of 10 mgm each at four hour intervals (oral)	.....	45	20
20 M.L.D.	20 mgm (oral)	.....	0	9
.....	20 mgm (oral)	10 mgm (subc.)	100	11
2 M.L.D.	....	10 mgm (subc.)	0	5
2 M.L.D.	20 mgm (oral)	10 mgm (subc.)	17	35
2 M.L.D.	Sulfathiazole 20 mgm (oral)	.....	50	20
10 M.L.D.	Sulfathiazole 20 mgm (oral)	.....	0	18
2 M.L.D.	Sulfapyridine 20 mgm (oral)	.....	75	16

1 M.L.D. is designated as the amount of antigenic material required to kill within 24 hours 50% of mice injected intraperitoneally with an aqueous solution of the antigen. By dry weight 1 M.L.D. equals 1.3 mgm of toxic material.

Since sulfanilamide is not in all probability a naturally occurring substance the question arises as to whether the protective effect of sulfanilamide results from increasing the general resistance of the body to the toxin, or whether sulfanilamide or one of the products into which it is converted by the body is utilized more specifically for a detoxication process. The first hypothesis is weakened by the finding of Carpenter and associates who observed that sulfanilamide protected mice against toxins produced by such gram positive organisms as *Staphylococcus aureus* and *Clostridium welchii,* both of which differ markedly in pathogenesis from the toxins of gram-negative organisms, particularly *Salmonella* studied by us and by Levaditi, and the *Neisseria* toxins studied by Carpenter and by Levaditi.

A specific detoxication mechanism for toxic proteins, aside from hydrolysis, has never to our knowledge been proposed. The experiments of Morgan[7] showing that the toxicity of typhoid antigen is not destroyed by its homologous antibody (in contrast to the neutralizing action in other toxin-antitoxin reaction mixtures, *e.g.*, diphtheria and tetanus) may suggest that some other means, presumably non-immunological, within the body is called upon to detoxify this antigen.

This action of sulfanilamide, if it is a detoxication of bacterial toxins, may represent a special instance of the enhancement of the general detoxication of proteins within the body.

[7] H. R. Morgan, *Jour. Immunol.*, 41: 161–80, 1941.

SUMMARY

Sulfanilamide compounds protect mice against multiple lethal doses of purified *Salmonella* endotoxin. This protective action of sulfanilamide is inhibited by *p*-aminobenzoic acid.

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ANTICIPATORY CARDIAC ACCELERATION DURING SLEEP

As a part of a series of studies of sleep motility[1] at the University of Virginia, recordings of the heart rate during sleep were made. The data obtained proved to be of considerable interest and served to indicate the nature of the stimuli causing sleep movements.

Johnson[2] has called attention to the fact that during sleep, when body positions are maintained for fairly long intervals, there is, among other things, an interference of circulation (stasis of the blood and body fluids in parts of the body) and an overheating of the unventilated portions of the skin. These conditions, he suggested, must become sufficiently irritating in time to lead to a change in body position. For convenience this shall be termed the congestion hypothesis.

It is a matter of common knowledge that, as Johnson mentioned, such stimuli become irritating and even painful after some minutes. Further, it has been shown that either restriction of circulation or raising of the skin temperature produces an increase in the heart rate. If these irritating stimuli were the ones causing movement, an increase in the heart rate prior to movement would be expected. According to the same reasoning, a decrease might be shown following movement, as a change in position would relieve the irritating conditions.

This reasoning led to an experiment in which the heart rate was examined in conjunction with motility. In order to rule out the possibility of experimental artifacts interfering with the normal circulation during sleep, the heart rate was determined electrically by means of a cardiotachometer. Each heart beat was recorded on a moving strip of paper along with the movements of the sleeper. A high-speed kinetograph was used to determine precisely the onset and termination of each movement. In this study only the larger movements involving a change in position of the trunk were considered. To obtain the heart rate uncomplicated by factors other than those under consideration, a given movement must be preceded and followed by several minutes of inactivity.

[1] Results of these studies are to be published.
[2] H. M. Johnson, T. J. Swan and G. E. Weigand, *Psychol. Bull.*, 27: 16, 1930.

Records for twelve complete nights' sleep of one subject were analyzed. From these records 83 movements conforming to the preceding criteria were ob-

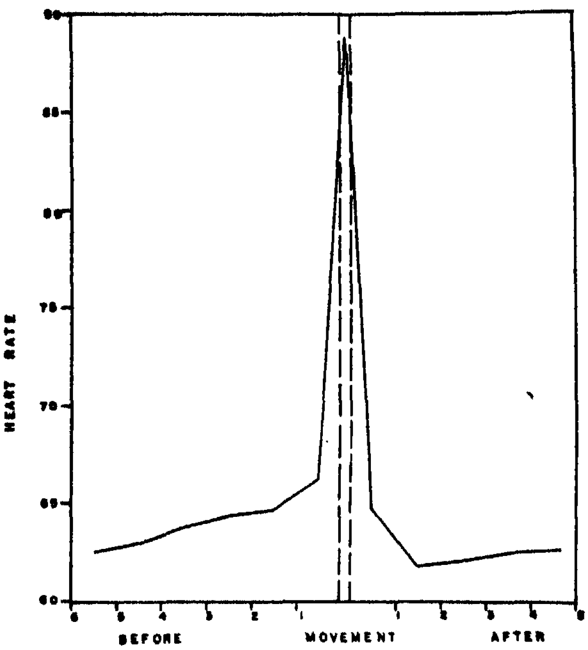

FIG. 1.

tained. The average heart rate for each minute of the period beginning 6 minutes before movement and terminating 5 minutes after movement is shown graphically in Fig. 1.

A trend of the sort suggested by the congestion hypothesis is apparent. An anticipatory increase in the heart rate is clearly demonstrated. From the curve, the rise appears to begin as much as 6 minutes before movement and the increment becomes greater until movement takes place. A minimum below that of any other period under consideration occurs soon after movement, and from this point there is a slow return to the earlier level. While of no immediate bearing on the congestion hypothesis, the much increased rate during movement is to be noted.

Analysis of the cardiotachometer records in quarter-minute intervals shows the same general trend, and the points of change are fixed more accurately in time. There is a slow rise continuing until one-half minute before movement. This is followed by a much more rapid rise that immediately precedes movement. This suggests that the anticipatory rise may be the resultant of two different functions. Statistical analysis of the data shows that both the anticipatory increase and the subsequent decrease are reliable.

These data are evidence of the correctness of the congestion hypothesis. Further experiments are planned to determine more specifically the nature of the stimulus and the mechanisms involved.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A RAPID METHOD FOR THE DETERMINATION OF NITROGEN IN PLANT TISSUE

IN view of the imminent shortage of critical elements which are necessary in maintaining crop production, it is becoming increasingly important that guess-work be eliminated in so far as possible in determining the actual fertilizer needs of economic plants. The chemical analysis of leaves as a means of determining the nature of nutritional disorders and as a tool in determining the fertilizer requirements of crop plants has received increasing attention in recent years. The investigations of Lagatu and Maume,[1] Thomas,[2] Thomas and Mack[3] and others have placed the theory of leaf analysis or "foliar diagnosis" on a sound basis. This method has not found wide application probably because of the time and expense involved in the chemical procedures usually employed. With these factors in mind, and faced with the necessity of analyzing hundreds of apple leaf samples in connection with nutrition studies, along with specimens of nutritional disorders frequently brought to the laboratory by fruit growers, we found it desirable to devise more rapid methods for the determination of some of the common nutritional elements in plant tissue.

Nitrogen is perhaps the element that is determined most often by agricultural and biological chemists, and practically all analyses are based on the standard time-consuming Kjeldahl method. A rapid acid-digestion procedure was sought which would make it possible to determine not only nitrogen, but also phosphorus, potassium, calcium, magnesium and other elements in the same sample. The use of 30 per cent. hydrogen peroxide in the presence of concentrated sulfuric acid was found to be a remarkably fast and thorough method for digesting relatively small quantities of plant material. The entire digestion takes only about five minutes, and total nitrogen, including nitrates, can be determined in the resulting solution by the standard nesslerization procedure using a photoelectric colorimeter of the test-tube type. The

[1] H. Lagatu and L. Maume, *Ann. Ecole Nat. Agr. Montpellier*, 20: 219–231, 1930.
[2] Walter Thomas, *Plant Physiol.*, 12: 571–600, 1937.
[3] Walter Thomas and Warren B. Mack, *Penn. Agr. Exp. Sta. Bull.* No. 378, 1939.

Koch-McMeekin Nessler reagent[4] was used in this work, although others would probably be just as satisfactory. Since Beer's law was not found to be valid over a wide range, a curve had to be prepared from readings based upon standard solutions of ammonium sulfate. Either fresh or dry material was found to be satisfactory for analysis, but the use of fresh material saved considerable time in sample preparation. A leaf punch which cuts out exactly one sq. cm of leaf tissue can be used, thus saving the time required to dry, grind and weigh the sample. Ten sq. cm of leaf tissue of most fruit trees is equivalent roughly to 100 mg of the dry material, and the area basis is just as satisfactory as a dry-weight basis for comparing samples.

The procedure adopted is as follows: Transfer 100 mg of dry material or 10 cm² of fresh material to a 50 ml Erlenmeyer flask. Add 2 ml of concentrated sulfuric acid and heat gently over a flame until the sample is broken down and partially dissolved. If nitrates are present, continue digestion for about a minute after dense fumes have been given off to allow for complete reduction of the nitrates by the organic matter. Allow to cool and add 0.5 ml of 30 per cent. hydrogen peroxide. Heat gently—the solution should become clear and colorless. Continue the heating until dense fumes are given off—usually the solution becomes darker at this stage. Allow to cool and add 5 drops more of 30 per cent. hydrogen peroxide and heat as before. If the solution is not completely clear and colorless on further heating, add 5 drops more of hydrogen peroxide and heat again—repeat this procedure if necessary. No more than 5 drops of hydrogen peroxide should be added at one time after the first addition, because a large excess of peroxide in the absence of organic matter will oxidize some of the ammonia. When the solution is perfectly clear and colorless on continued heating, cool, dilute with water and transfer with washings to a 100 ml volumetric flask and make to volume. Transfer a 10 ml aliquot to a 50 ml volumetric flask. Add 2 ml of 2.5 N NaOH to partially neutralize the excess acid and 1 ml of 10 per cent. sodium silicate to prevent turbidity. Make to volume and mix well. Transfer a 5 ml aliquot to a colorimeter tube and add 4 drops of Nessler's reagent—mixing thoroughly after the addition of each drop. If the mixing is not thorough, additional drops of reagent will be required to obtain the maximum color. Allow to stand for several minutes before taking a reading on the colorimeter. A blue filter (Wratten No. 49) was used in this work.

Typical comparisons between the rapid and the Kjeldahl methods and recoveries of nitrate nitrogen added to apple leaf tissues are shown in Table 1.

[4] F. C. Koch and T. L. McMeekin, *Jour. Am. Chem. Soc.*, 46: 2066–2069, 1924.

TABLE 1

REPRESENTATIVE ANALYSES OF APPLE LEAF TISSUE AND RECOVERY OF ADDED NITRATE NITROGEN. EXPRESSED AS PERCENTAGE OF DRY MATTER

Sample No.	Kjeldahl method	Rapid method	1 per cent. N added as $NaNO_3$	Recovery of added NO_3
61	2.73	2.73		
	2.73	2.71		
111	.70	.75		
	.69	.74		
216	1.77	1.81		
	1.80	1.81		
291	2.22	2.23		
	2.28	2.26		
315	1.37	1.40	2.40	101 per cent.
	1.39	1.40	2.40	101 " "
		1.37	2.41	102 " "
215	1.88	1.89	2.89	100 " "
	1.89	1.91	2.86	97 " "
		1.86	2.88	99 " "

The time required to determine nitrogen by this method in routine analysis was found to be about 10 minutes per sample, making it possible for two analysts to complete at least 48 samples a day. Furthermore, the cost of reagents is only about one twelfth that of the Kjeldahl procedure. Numerous nitrogen determinations made on replicate samples of leaves of apple, pear, peach, cherry, apricot, grape and corn gave Kjeldahl accuracy. The solution obtained from the peroxide-digested material can be used not only for the determination of nitrogen, but also for phosphorus, potassium, calcium and magnesium. Rapid colorimetric methods for the determination of these elements have been worked out and are now being prepared for publication.

Since leaf analysis offers the most promising means of diagnosing nutritional deficiencies and unbalance within the tissue of the plant, and since it eliminates most of the uncertainty in determining the actual fertilizer needs of crop plants, it is hoped that by the adoption of faster methods, leaf analysis, as a tool in increasing crop production, may come to be more widely used.

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BOOKS RECEIVED

Fink Ollie E. *Conservation for Tomorrow's America.* Illustrated. Pp. 144. The Ohio Division of Conservation and Natural Resources. $.50.

Mizwa, Stephen P. *Great Men and Women of Poland.* Illustrated. Pp. xxviii + 397. Macmillan. $4.00.

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Peattie, Roderick. *How to Read Military Maps.* Illustrated. Pp. v + 74. George W. Stewart, Inc. $1.50.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE DEATH RATE

A HINT that the shortage of doctors is already affecting the national health picture may be found in the death rate for eighty-eight large cities. For the week ending December 5, the latest on which figures are available, this took a big jump, to 13.5 per 1,000, although there are no signs of epidemics.

The increase was largely due to the mortality from the Boston night club fire, but correcting for this gives a death rate for the large cities of 12.8 per 1,000. The rate for the corresponding week in 1941 was 11.9 per 1,000, and the three-year average for the first week in December is also 11.9 per 1,000.

The death rate of 13.5 per 1,000 for the 88 large cities comes from the Census Bureau, and is based on total number of deaths without regard to cause, age or other factors. The U. S. Public Health Service, however, gets weekly reports from 88 large cities on pneumonia and influenza deaths. These are not all the same cities as covered by the Census Bureau weekly report. Different cities are included in order to get a better geographic picture of the influenza-pneumonia situation. The death rate for influenza and pneumonia based on the reports from these cities is also running higher than the average for the past three years at this season.

Influenza cases reported by state health officers to the U. S. Public Health Service increased somewhat during the week ending December 5, but neither the increase nor the total number of cases is large enough to indicate an epidemic.

With no epidemic and no reports so far of a more virulent type of pneumonia or influenza, the only suggested explanation for the increased death rate is lack of medical care resulting from the shortage of physicians.

ALIEN-OWNED PATENTS

MANY applications have already been received by the Office of the Alien Property Custodian at Washington for licenses to manufacture devices and materials covered by alien-owned patents, under the policy announced by the President. Something over 27,000 such patents are now tabulated; they comprise all categories as classified by the U. S. Patent Office.

Of especial interest to American manufacturers, as judged by the numbers of applications, are patents in the fields of chemistry and metallurgy. The largest single class is organic chemicals, particularly drugs. Dyestuffs are also the objects of numerous inquiries; though probably the interest here is not quite so keen as it was in World War I days, when this country found itself "caught short" by the shutting off of the German aniline products on which we had become too dependent. That situation has been remedied during the past couple of decades.

Metallurgical patents of greatest interest to American industrialists seem to be divided principally between steel and the light metals, aluminum and magnesium. Steel makers want to try out electrical methods of smelting, and they also want to make certain types of alloy steels covered by German patents now vested in the Alien Property Custodian.

There are some applications for licenses in the field of fuels, especially gases, such as the manufacture of acetylene out of natural gas. This of course is of special importance in welding.

Among the mechanical patents available for American use under the new ruling are many on aircraft and their accessories, that were taken out by such noted German firms as Focke-Wulf and Dornier. Very recently issued, for example, is the U. S. patent on the Dornier "umbrella-tailed" dive bomber that has already been seen in action and photographed by British observers. German and Italian experimental rocket-propulsion motors for planes are also covered by patents held in custody here, which are now available for American experimentation if desired.

German physical laboratories have been the scene of great activity in the development of electron microscopes, if patents taken out in this country are a good criterion. These designs can now be taken over under license and their best features adapted to our own use, should they seem suitable for incorporation in American instruments.

THE SUPPLY OF BELLADONNA

FIELDS of belladonna, the drug called deadly nightshade, have been harvested by American farmers for the first time to replace former imports from central Europe. That yields are good and quality satisfactory is reported by the U. S. Department of Agriculture. The average content of active constituents is almost twice the U. S. Pharmacopoeia standard.

Medicines are prepared from belladonna leaves, roots, or the potent white crystals extracted from them. Physicians often prescribe them for such uses as relaxing asthmatic spasms, drying and dilating the bronchial tubes and to relieve pain. Belladonna liniment or plaster has long been used for relief of neuralgic or rheumatic pain and in the form of suppositories for painful hemorrhoids. Eye specialists use it extensively to facilitate examinations because it paralyzes the adjustment mechanism of the eye and dilates the pupil. The name, bella donna, itself means "beautiful lady," referring to its use by the women of old Italy to dilate the eye pupils, giving them a more alluring luster.

Although some of the drug has been grown in this country for many years, the main source has been central Europe. But in 1940 the Bureau of Plant Industry anticipated a shortage and planted the drug for seed. It has since bought seed from other sources. This was distributed last spring to growers and between 400 and 500 acres were harvested this fall in Wisconsin, Pennsylvania, Virginia, Tennessee, Ohio and other states.

The Agricultural Research Administration of the Department of Agriculture estimates that supplies are ade-

quate at present to meet military and civilian needs. Only a small acreage is needed to supply the nation.

DEHYDRATED FOODS

MANY vitamins are found in dehydrated foods if they are properly treated, was reported by Dr. Agnes Fay Morgan, head of the Home Economics Department of the University of California, to the representatives of the dehydration industry at the Western Regional Laboratory, summing up results on vitamin retention brought out by the past several years of research at the university.

Fruits dehydrated under the new factory processes retain more vitamins than those preserved by sun drying. While prunes, peaches and apricots are good sources of vitamin C, only those treated with sulfur dioxide retain this vitamin. On the other hand, the sulfur treatment destroys two thirds of the vitamin B_1, as the thiamin molecule is split by sulfur dioxide. Since peaches and apricots are not rich in B_1, sulfuring is probably desirable in their dehydration. Vitamin A is stable and is retained in both dehydrated and sun-dried fruits, but riboflavin is quickly destroyed by light so that sun-dried fruit has lost most of its vitamin B_2, while dehydrated fruit shielded from light, retains it.

In the past two or three years, Dr. Morgan and her staff have been interested in the retention of vitamins in dehydrated vegetables. Several of the dehydrated vegetables have better vitamin retention than the same ones canned. Spinach, for instance, lost 75 per cent. of its B_1 when canned, as compared to the fresh spinach, but in dehydrated spinach the B_1 was preserved almost 100 per cent.; canned peas lost 73 per cent. of B_1 as compared to a loss of 10 to 20 per cent. in the dehydrated. Concentrated tomato juice, tomato paste, and dehydrated broccoli are good sources of vitamin C.

In summing up the value of the dehydrated vegetables, Dr. Morgan stated that the vitamin C loss was from 20 per cent. for broccoli to 80 per cent. for string beans. For B_1, the loss in several vegetables ran from 14 per cent. to 33 per cent.; B_2, 25 per cent. to 50 per cent., with an exception in dehydrated carrots which had a loss of only 12 per cent. In all the vegetables tested the carotene destruction was small, while $\frac{1}{3}$ to $\frac{1}{2}$ of the nicotinic acid was lost, probably due to leaching.

Studies on meat showed that there was less loss of vitamins B_1, B_2, and nicotinic acid in dehydrated than in canned meat. The cooked dehydrated meat compared favorably with the cooked fresh meat, since there is always some loss in preparation for the table.

Vitamin assays up to three to four years ago were solely a matter of feeding animals. These take at least two months and are only reproducible within 15 to 20 per cent. Chemists have attempted to shorten the process by the use of chemical and micro-biological methods. "There is no consistency between the various tests," Dr. Morgan stated. "In each case it is necessary to check the short methods against tests on rats."

ITEMS

A REQUEST from the USSR was received by the U. S. Department of Agriculture as early as last April, for seed "to sow land plowed by German tanks." Tons of seed are now on the way, to grow up as next year's crops. Seed shipments are the most effective kind of lend-lease aid that it is possible to send. Mere ounces of cargo weight grow into hundreds of pounds of food. Moreover, seed symbolizes the will and ability of peoples in the war-pressed lands to help themselves. In becoming a seed-growing and seed-exporting nation, the United States is reversing the pre-war set-up, when we were heavy importers of seed from Europe, especially from Denmark, the Netherlands and France.

THE lowest pneumonia and influenza death rate on record among its industrial life insurance policy holders was achieved in the last annual cycle, September, 1941, to August, 1942, the Metropolitan Life Insurance Company announces. During that period the average pneumonia-influenza death rate was equivalent to 32 deaths per 100,000 persons. This is 21 per cent. less than the previous low record made the year before and 63 per cent. less than the rate five years before. Most striking is the change in the picture during the winter months when pneumonia and influenza deaths reach their maximum. During the winter of 1936–1937, considered an average winter at that time, pneumonia and influenza deaths reached an extremely sharp peak in February with a rate of more than 175 deaths per 100,000 persons on an annual basis. At the end of February, 1942, the peak was just over 50 deaths per 100,000 persons on the annual basis. The death rate for the winter months was 70 per cent. less than in the winter of 1936–1937, and the seasonal mortality curve has flattened out so as to be "almost beyond recognition."

MOTHERS to-day are younger, but the burden of maintaining our birth rate near its present level under war conditions will fall on the women over 30 years of age, according to statisticians of the Metropolitan Life Insurance Company. In 1920, they report, women under 20 were contributing 8.6 per cent. of the total births for the year but by 1940 women of this age group contributed 11 per cent. Women of 20 to 24 years also contributed an increasing percentage of children to the nation, from 28.1 per cent. in 1920 to 31.3 per cent. in 1940. During the same two decades, women of ages 30 to 34 contributed fewer children to the nation, the percentages dropping from 19 to 17.7 per cent. The percentage of younger women in the population, however, has decreased and that of older women has increased during the same two decades. This trend will probably increase. At the same time the war has interrupted family life most for the younger women who will consequently contribute fewer children. This places the burden of maintaining the birth rate on the women of thirty years or over, which means the average size of existing families must be increased. The unfavorable effect of the war on the birth rate of the immediate future may be moderated, because most married women of 30 years or more already have children so that their husbands are for the most part still out of the classes called for military service. In addition, many thousands of these families are now in better economic position than ever to rear more children.

SCIENCE

VOL. 96 FRIDAY, DECEMBER 25, 1942 No. 2504

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

A UNIFIED COMMAND AND DEMOCRACY IN AGRICULTURE[1]

By President JAMES D. HOSKINS

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No question to-day, I dare say, is more subject to debate than the problem of a unified command. Yet it is scarcely a matter of debate. Military experts, statesmen, laymen in high quarters and an aroused public are demanding a unified command! For the United Nations at large, for the armed services of each, and for the wayward committees, commissions, bureaus and departments throughout our decentralized democracies—the immediate postulate of hope for victory in this war is a unified command. It is more of a battle cry than an argument.

While we confess to the need for such a command in war, let us not forget for a moment what we are about. The perils of the cure are but little short of those of the disease itself. We are but fighting fire with fire. For the ultimate potentiality of the unified command is the totalitarian state. Our security lies in our recognition of both the strength and the weakness of democracy. It lies in our ability to put aside our inherent weakness of individualism and prolonged debate in order to assume the full power of our strength in unity of purpose under a unified command. That we are slow to do so is but evidence of our whole-hearted commitment to decentralization of authority and to local autonomy. Our departure from these basic tenets of democracy is but temporary and for the sole purpose of winning a war. Otherwise,

[1] Address by the President of the Association of Land-Grant Colleges and Universities at the fifty-seventh annual meeting in Chicago, October 28, 1942.

the democracy we have known is gone from us forever, and the post-war world will be foreign to our conceptions.

THE POST-WAR WORLD

I would speak to you to-day of the post-war world and the place of the land-grant college in that world. There are those who would decry this theme. There are those who contend our whole thought and energy must be devoted to the present moment—to winning the war, that is—and the post-war world can wait the event of victory. But how can this position be maintained? How can we motivate the effort necessary to achieve victory except as we are permitted to visualize the fruits of victory? Can any worth-while end whatever be achieved—except a jack-pot or a dice game gamble—without a clear conception of the end sought? The scientist, the scholar, the world's workers are not gamblers. Nor can the present world carnage be conceived as a crusade for democracy save as the post-war world is clearly perceived as democracy.

It is the clear responsibility of some one—and, I think, of the colleges and universities—so to shape this post-war dream that it shall be worth fighting for. Indeed, I shall go so far as to say that the present war can not be won—as it is not worth fighting—unless all of us have a better world in mind to motivate our arms. Thus, if you please, in addressing myself to the problem of a unified command and of democracy in agriculture, I have in mind primarily the preservation and certainly the restoration of democracy in agriculture in the relationships of the land-grant college, but I am convinced, too, that in our discussion we are planning for victory itself as well as for the fruits of victory to be enjoyed at some later time.

THE LAND-GRANT BACKGROUND

Last year I reported to the executive committee of this organization upon a most significant problem confronting the land-grant colleges. I must review it briefly to lay the foundation for such action as the association may deem necessary.

It is significant, to begin with, that the U. S. Department of Agriculture was established by act of Congress in 1862, the very same Congress enacting also the Morrill Act for the endowment, support and maintenance of the land-grant colleges. An identical philosophy of aid to agriculture inspired both acts and founded a national policy of cooperation between these two agencies which has been maintained down the years. What is even more important, the Congress laid down a pattern of cooperation between the Federal Government and the several states, marked by democratic procedures in agricultural education and research and the formulation and development of programs for farm people. The Congress also defined the contribution each agency should make to the development of the nation's agriculture in mutual cooperation.

With legislative assent to the Morrill Acts of July 2, 1862, and of July 23, 1866, the several states accepted the educational and research responsibilities of this cooperative relationship. The national pattern therefore became more or less uniform between the several states and the Federal Government for the development of agricultural aid programs in the democratic way—namely, the Federal Government functioning in the several states through the land-grant colleges or in close cooperation. Congress further developed this pattern by the Hatch-Adams Act of 1887, providing state agricultural experiment stations, and the Smith-Lever Act of 1914 for extension in agriculture and home economics. A subsequent Memorandum of Understanding between the colleges of agriculture and the U. S. Department of Agriculture developed the policy still further. And so for seventy years all went well.

In their cooperative relationships the two agencies have made use of the research of the scientists of the respective experiment stations; the research work of the scientists of the U. S. Department of Agriculture; the practical demonstration experience of the extension agent; the knowledge of the resident faculty of the college; and in brief the facts and information from all state and federal agencies that could make a contribution in the formulation and development of the program. Of even more importance, they have utilized the active help and guidance of farmers and farm women whom the program is designed to help. This is democracy in the development and administration of agricultural programs. This has made it possible to adapt agricultural programs to local types of farming areas.

THE ALTERED TREND

And now please note briefly the changing philosophy in the U. S. Department of Agriculture at Washington, the disruption of the established policies and the beginnings of a unified command which threatens the democratic foundations of this cooperative work.

Until 1933 almost all Federal funds for development and aid to agriculture were as grants in aid to the states and were administered by—or programs were developed in close cooperation with—the land-grant colleges. At the present time these grants in aid are very small in contrast with monies expended by recently established agencies of the U. S. Department of Agriculture which deal directly with the farmers and not through the colleges. In substance these agencies pay the farmers for putting into effect better farming methods, whereas the Agricultural Extension Service can only recommend these pro-

grams. In 1940 three of these agencies spent for personnel alone approximately $123,000,000 in contrast with $18,500,000 allotted to Agricultural Extension Services in the 48 states and two territories.

Consider, please, the confusion which results when: The AAA is requesting farmers to execute a farm plan to participate in payments for Soil Conservation practices. The Farm Security Administration requests clients to execute a farm plan to be eligible for loans and grants-in-aid. The Soil Conservation Service is requesting farmers to execute a farm plan on farms included in Soil Conservation districts. The Agricultural Extension Service of the college is, also, aiding farmers in planning their farms in the most efficient manner. Here are four agencies operating in the same county, and on the same farm in many instances, each endeavoring to help the farmer plan his farm.

Inevitably there is the tendency to centralize in each of these agencies all the phases of the agricultural program, educational and research functions along with the fiscal and regulatory. And there is the further inevitable result of centralizing the control of all these agencies in the Department of Agriculture at Washington. Here, then, is the unified command of aid to agriculture which threatens to shatter the whole democratic base. Instead of farm programs developed in the local communities by the farmers themselves—with aid delegated to the several states through the established cooperative relationship of the land-grant college and the U. S. Department of Agriculture—there is the field personnel of Federal agents responsible not to the citizens of county or state but directly to Washington.

It is not my duty to fix responsibility nor to cast stones at any one for this drift of affairs. There has everywhere—and not in agriculture alone—been a drift toward centralization of power in the Federal Government. Federal subsidy has cast its tentacles around the states in education and transportation, to mention only two other public services. We seldom hear, these days, as we probably should, of the struggle for "states rights." But there are two very definite factors to be considered in agriculture's waning democracy of procedure and the waxing of a unified command. One of them is the subsidy itself. Washington can, unfortunately, buy its way into complete control unless our democratic conscience and consciousness awake to the peril of the subsidy—frequently conscience money and always from the citizens' own purse. The second factor has been the failure of the land-grant colleges themselves to accept and administer uniformly the programs enacted by Congress, notably the first AAA act of 1933. The Secretary of Agriculture called upon the Agricultural Extension Services of the several states to put the educational phases of this program into operation under the cooperative terms of the original (1862) relationship. Most states assumed this responsibility, but some did not, apparently interpreting differently their responsibilities under the Morrill Act and the 1914 Memorandum of Agreement. And indeed, the Department of Agriculture had to negotiate a different working agreement with each of the land-grant colleges. Inevitably this factor alone would have driven responsible federal officials to think in terms of a unified command.

The Democratic Base

I should like to point out how contrary to democratic principles a unified command of this sort over this segment of our national forces would be. Aside from the individualistic nature of farmers, who merely might not "like" a strongly centralized authority over their destinies, farming itself does not lend itself to either long-distance or general planning. Farming is local and particular—to such an extent, for example, that no general textbook in agriculture is ever satisfactorily applicable to most sections of the country. Weather and topography combine with human nature to make America inevitably democratic. Unless we blindly permit the short-sighted among us to thrust our heads and hands and feet in the stocks of totalitarianism, we must be free and democratic by virtue of the difference between and among us. A plan for one farm in our state of Tennessee, for example, is difficult enough, for on one side the farm is likely to be lush meadow and marsh while on the other it rises to limestone hills or flinty mountain tops. I am quite sure that only Tennesseeans can plan for Tennessee, and for my part I beg to be excused from enforcing plans upon Illinois, Texas or Maine. Who but the land-grant college has employed the agronomists and soil specialists and engaged in hundreds of research projects to determine what any given state affords and needs? What agency but the same college is perennially engaged with the shifting scene, in season and out? I can not conceive of a federal bureau, however well intentioned, achieving the decentralization of knowledge and effort necessary to succor and relieve the farmers of America, now benefiting from day to day by the localized effort of the land-grant college.

I concluded my report to the executive session last year with these words:

> There should be just one educational source in the state to which all farm people should look for information in agriculture and home economics, in connection with agricultural programs, and logically this is the land-grant college. There should be just one agency contacting the farm family to aid it in developing farm plans best suited to its needs, and the logical agency to assist farmers in

making such plans is the Agricultural Extension Service. All other agencies of the U. S. Department of Agriculture should be so coordinated around this educational service as to help the farmer develop the farm plan best suited to him. The college can assume these educational functions without becoming enmeshed in fiscal and regulatory activities. The foregoing coordinated relationship between these agencies will make it possible for the land-grant colleges to contribute most effectively to these programs, preserve their democratic administration, prevent a growing duplication and overlapping of services, achieve the most economical and efficient administration and eliminate the misunderstanding and confusion in the minds of farmers.

Recent Events

Events of world-wide significance have taken place since the last meeting of this association, almost a year ago. At that time, we were preparing to defend ourselves and our democratic institutions from the power and ruthless philosophies of foreign, totalitarian nations. To-day we are actively at war, and challenging, with our allied nations, the power and philosophies of these nations. We are determined to stop and crush their onward, destructive, looting march throughout the entire world.

The United States is at the crossroads and in the gravest crisis of her history. Freedom of the people, democratic institutions and a whole way of life are in peril. There is no turning back from the task we have undertaken. We must not only fight to preserve our national ideals, but we must guarantee to the oppressed peoples of the world the same right to life, liberty and the pursuit of happiness that we claim for ourselves.

At this annual meeting, therefore, the association may well consider, in the various sessions, the contribution the land-grant colleges can make toward winning this war, and toward the perpetuation of the ideals of liberty and democracy inherent in the government of the United States. The programs of the various sessions have been arranged for consideration and discussion of the adjustments necessary to this end.

For my part, I would conclude my recommendation concerning a unified command. It is generally recognized that the exigencies of war require centralization of administration of certain powers and war programs to a degree unprecedented in peace. This is necessary for the complete mobilization of all the material and human resources essential to winning the war. That is certainly true in this war, the most gigantic struggle in which the United States has been engaged. The welfare and security of all the citizens are more important than the personal liberty, independence and rights of individual citizens. Drastic situations require measures to meet them. I think all the land-grant colleges concur in this philosophy.

There is necessary a Selective Service system to select and train the manpower of the United States for the great task of protecting our liberty and independence. It is logical that there be a War Production Board to see that these men get the tools and instruments of war in great quantities. It is our duty to see that the supply line operates from the home front to the fighting front in an uninterrupted flow. There is necessary an Office of Price Administration to control the cost of living and to distribute as uniformly as possible to the citizens of the United States, according to need, the necessities of life that are available to the civilian population.

Similarly there is need of an Office of Defense Transportation to conserve the transportation facilities for war needs. Also, an Office of Civilian Defense for air-raid protection, fire control and other services; also an Employment Service and Man Power Commission to direct effectively our labor where it may be most effective in the war effort, and many other agencies for the effective waging of war.

For the duration of the war, also, there may be necessary greater centralization in food production programs for lend lease, armed service and civilian demands. The important thing is to see that the food is produced to meet these requirements—and before this war is over rather drastic measures may have to be resorted to in labor placement or more specific designation of essential food and fiber crops consistent with the labor available.

All these war measures exercise controls of one kind and another on the civilian population and guide and direct the action of each individual citizen in the war effort. They limit or subordinate his independent action for the sake of a greater good to the citizens as a whole and their security, freedom and independence. Just how severe these controls may become depends on what it may take to win the war. Logically all such programs must be highly centralized in various departments of the government, and the Chief Executive must be given broad wartime powers in an emergency. It is here we enter into the twilight zone between democracy and totalitarian government, where the unified command is necessary as a temporary measure but if adhered to permanently is the end of democratic procedure.

Thus it is, that despite the fact that our greatest task at the present time is to adjust our resident instruction, research and extension activities toward winning this war, we must look forward into the future, into the post-war world. And we must see to it that these controls are released as rapidly as the public welfare warrants and that our democratic institutions and procedures in planning and developing educational and research programs are in accordance with the pattern laid down by the Congress of 1862

in the acts creating the U. S. Department of Agriculture and the land-grant college. This, then, is the specific recommendation that I bring before this body —the restoration of the democratic relationship between the U. S. Department of Agriculture and the land-grant colleges and other departments and agencies of the Federal Government all along the line—as swiftly as possible in the post-war world.

FURTHER RECOMMENDATIONS

We should be looking ahead, also, to broadening the pattern of cooperation to include engineering research in the College of Engineering and also research in home economics. The Morrill Act, in addition to specifying the teaching of agriculture, also provides that mechanic arts shall be taught. The teaching of mechanic arts is just as dependent on research as agricultural teaching is, and research in this field is just as much a governmental function. It has always seemed to me that resident instruction in the mechanic arts should be supplemented with research in the same way the Hatch-Adams Act of 1887 supplements resident instruction in agriculture with research.

A study of the Morrill Act and the statements of Justin Morrill indicate that it was his intention as well as his associates' in Congress that equal opportunity and facilities in the field of agriculture and engineering should be available. This will not be the case until the same amount of federal funds are available for engineering research as are available for agriculture. We should work toward this end.

The demand for engineers at this time in war industries and in the armed services emphasizes the importance of this expansion at the present time. We are living in what has been called a technological machine age, and the war in which we are engaged is a highly mechanized war. Such conditions call for more highly trained engineers and indicate the need for increased research in this field.

Nutrition for human beings is a rapidly developing science. For many years we have been studying the nutritional habits of live stock, and at last I am glad to say we are getting around to the serious study of nutrition for our citizens. Certainly this should be one of our most important sciences since it is so vitally concerned with human welfare. There is much to be explored in this field. If we are concerned about money for research in agriculture and in engineering, we should be equally concerned about funds for research in this field of human welfare which we know as home economics.

The Agricultural Extension Service is carrying a very heavy load. This, of course, is the division of the college through which education in connection with all war programs is carried to the public—for scrap metal and salvage, for war bond and stamp sales, for essential food and fiber production goals, for price control and so on. A special committee has gone before the Bureau of the Budget to appeal for emergency funds for increased personnel to carry on these expanding programs. What this committee has accomplished remains to be seen. In any event, if the Agricultural Extension Service is to assume these increased war duties, increased Federal funds should be available.

There is no body of men and women anywhere in this country who are working with greater unity of purpose to win this war than the teaching, research and extension staffs of the land-grant colleges. They bring to our young men and women the right appreciation of the obligations which they have to our national life, and upon this appreciation the perpetuation of our democracy depends. In the democratic policy or pattern provided for in the Land-Grant College Act, and the act creating the U. S. Department of Agriculture, and the cooperative relationship between them during the past eighty years, the land-grant colleges have made a great contribution to the development of the nation's agriculture and industry. Their usefulness has continually increased. This relationship sets a pattern for all educational programs sponsored jointly by the Federal Government and the states. This relationship is essentially the democratic process in the development of educational programs for the masses of the people and is the basis of an enduring democracy and of democratic institutions.

THE FULLER UTILIZATION OF SCIENTIFIC RESOURCES FOR TOTAL WAR[1]

By Dr. THEODOR ROSEBURY

ASSISTANT PROFESSOR OF BACTERIOLOGY, COLUMBIA UNIVERSITY; CHAIRMAN, NEW YORK BRANCH, AMERICAN ASSOCIATION OF SCIENTIFIC WORKERS

To the scientific worker it is a matter of the gravest concern that the scientific resources of the nation are still far short of full mobilization for war. Scientists are involved in this war as are all people: their deepest interests as citizens, in common with all others, are threatened to their foundations. But they have a spe-

[1] Presented at a meeting of the New York Branch, American Association of Scientific Workers, New York, October 7, 1942.

cial interest in the war beyond the ordinary. Science has perfected the weapons of war, trained its immediate personnel and provided the means both for defense against it and for the repair of its ravages. Science operates in this war on the fighting front, in the factory, in the laboratory and also in the mind of the scientist. The skilful use of the weapons of war; the efficient production of the best weapons; the development of still better weapons; and the discovery of principles and techniques that underlie still further development—all these aspects of science are indispensable for total war. Weapons are not alone guns, tanks and planes. They are also ships, trucks, roads and bridges; they are food, clothing and shelter; they are vaccines and sulfonamide drugs; and—by no means least important—they are ideas. Total war demands all our resources for its successful prosecution. We are not yet waging total war; nor are we yet winning significant victories. Lack of full utilization of scientific resources is one phase only of a more general deficiency. It is an important phase, and one to which we, as scientific workers, can and must address ourselves with particular attention.

Total war demands the utmost efficiency in leadership from above, and alike in cooperation from below. Neither the leadership nor the people by themselves can hope to achieve victory except by working wholeheartedly together and by both demanding and permitting the fullest possible utilization of the potentialities on both sides. Neither can be deficient without impairing the efficiency of the other.

As a member of the American Association of Scientific Workers and an active worker in the War Effort Committee of its New York branch, I should like to speak for the "people" in science. I urge them to cooperate whole-heartedly in the war effort; and I urge the leadership in science to demand and to permit that whole-hearted cooperation. I offer constructive suggestions as to ways and means, based on the experiences of the association.

The American Association of Scientific Workers has been increasingly concerned with the problem of complete utilization of scientific resources in the war effort, especially from the standpoint of facilitating and encouraging volunteer work by individual scientists and local groups. Although small in scale and more fruitful up to the present in promise than in accomplishment, our activity has convinced us both of the need for work of this kind and of the practicability of our approach. Extension of such activity on a larger scale will, we feel sure, bring concrete results that will exert a very appreciable influence on the total war effort.

The association has endeavored to present the problem of the utilization of scientific resources as a basis for action. Communications on the subject have been published;[2] and a memorandum submitted to the National Academy of Sciences on July 30 suggested means whereby the academy and other leading scientific bodies might aid directly in solving the problem.

What is the current extent of failure to utilize our resources of science? More precisely, what proportion of our total scientific man-hours and equipment-hours is being unused or used for non-essential or non-contributory purposes—for "business as usual"? Unfortunately, in the absence of adequate statistical data, no such precise formulation is yet possible. Compilation of these data is badly needed. It is nevertheless possible to define the problem from the experience of the association with sufficient clarity for the present purpose.

Certain fields of science are being very largely utilized for war purposes. Workers in the physical and mathematical sciences, engineers, and physicians, dentists and veterinarians have been absorbed into the war effort so rapidly that shortages in these fields on the home front are actually becoming critical. Such shortages, especially of physicians, may depend in part upon an aggravation of previously existing faults of distribution, and may therefore reflect the problem of efficient utilization as much as that of simple conversion of personnel from peacetime to wartime work. In these fields, at all events, the chief problems appear to be those of most effective utilization of the limited resources that are available, and of maintenance of the supply of trained personnel by accelerated education. These are the front-line sciences; their need for the war effort is most immediately apparent.

Among chemists, on the other hand, our experience shows more "business as usual" than we have any right to tolerate. Chemists contribute to both the physical-engineering and the medical front lines. Their importance, in chemical warfare itself, in the development and improvement of synthetic and substitute materials such as rubber and of therapeutic agents and other biological products, needs no extended emphasis. As might be expected, more complete use has been found in war work for physical chemists than for those in other categories. There should be room in the war effort, however, for competent chemists of all kinds. There is no doubt that not all competent chemists are being so used.

The medical sciences seem to be still further behind the goal of full utilization. These sciences, including physiology, biochemistry and bacteriology, are to medicine what production, development and invention are to ordnance. They are being utilized under the effective leadership of the Committee on Medical Re-

[2] (a) J. E. Hawkins, SCIENCE, 95: 2472, 507–508, May 15, 1942; (b) C. Behre, H. Grundfest and E. A. Kabat, *ibid.*, 96: 2479, 16, July 3, 1942; (c) H. Grundfest, *ibid.*, 96: 2492, 318–319, October 2, 1942.

search, one of the two major subdivisions of the government's Office of Scientific Research and Development. Many problems in important fields have been allocated and are being worked on, including means for control of many infectious diseases, the handling of war injuries and burns, the causes and control of shock, the storage and preservation of blood and the use of blood substitutes, and the control of nutritional deficiencies. In medical schools, moreover, scientific workers, who are nearly always teachers as well, have been given less time for research in the accelerated program of teaching. There are nevertheless many competent medical scientists who have time for research and who have not yet been utilized for war work. Their research continues on a "business as usual" basis, rarely by choice, but because the CMR has not reached them with problems, and because they themselves have not known how to find war work.

Among the subdivisions of biological science other than those directly contributory to medicine the problem of utilization is evidently still more serious. Biologists and agricultural scientists have no central government agency like the CMR, with money to spend and power to initiate and coordinate war research. They recognize the need for work on such problems as the new or improved production and conservation of natural materials like foods, fiber, forest products and rubber, and the ecology of animal and insect agents and carriers of disease. By and large they have not been able to initiate intensive study of these problems. As individuals they are still largely unused in the war effort, clearly not because of any lack of willingness on their part, but because the means for their conversion from a peacetime to a wartime basis have not yet been found or made available.

These are the broad outlines of the problem. Science is basic to the war effort. A vast amount of scientific research and development work has been and is being allocated, implemented and coordinated under the leadership of the OSRD and through its two major committees, the National Defense Research Committee (for physical sciences) and the Committee on Medical Research, cooperating through the National Research Council with many subcommittees for individual fields. It implies no serious criticism of this leadership to point out that its efforts to date afford no basis for complacency. Many of our scientific resources have not yet been utilized. We can not afford to waste any of them in total war. It can not be seriously argued that all the really important problems have been assigned or that all the really competent scientists have been absorbed into war work. This would be complacency at its worst, equivalent to the view, now seldom expressed, that the Army and Navy will fight the war for us, and the people may rest. The people have too much at stake to rest while they can help. Unused scientific resources are unconscionable in total war.

Leadership alone, however competent, is not enough; and if it were to attempt to work alone, without exploring and opening all possible avenues for cooperation from below, it would be shirking an indispensable part of its duty. The OSRD and its supporting agencies can not be expected to envisage all possible scientific war work, or to reach down to every scientific worker and find the proper job for him, without requiring, or at least encouraging, each individual worker to find his own place and to help others to do likewise. Fortunately the manner in which the OSRD operates includes provision for just such individual volunteer effort. Any responsible scientific worker can formulate a war project and submit it as an application for a contract to the OSRD or to one of its subcommittees. If the application is approved a contract is granted, and funds for assisting personnel and for equipment and supplies are made available for the work. This provision for volunteer effort, however, has not been widely publicized, and does not seem to have been put into practice on an extensive scale. Its usefulness has been impaired by the requirement of secrecy imposed on war research by the military authorities. Because much current research remains unpublished, scientific workers fully conversant with the literature in their fields may be unable to determine whether a given problem is already being investigated, and through fear of useless duplication may fail to apply for an important contract. We do not question the need for secrecy in many war research problems; but our experience suggests that secrecy regulations have not been adequately clarified, and that in many instances the restrictions in practice are much more severe than either the regulations or the needs require.

Recent experiences of a group of bacteriologists in New York indicate some of the means that are waiting to be used to encourage and facilitate volunteer scientific activity. This group was organized through the efforts of the New York branch of the association, as an outgrowth of the experience of its war effort committee, and is now an autonomous body. Its purpose is to consider aspects of bacteriology and related sciences that are of current war importance, and from open discussions to formulate war research projects that can be undertaken by members of the group after approval by the OSRD. A meeting held September 23 for discussion of vaccines against enteric infections was attended by more than two hundred bacteriologists, immunologists, pathologists and biochemists. Two invited speakers presented complementary aspects of the subject. During more than an hour of discussion from the floor after the presentations, seven problems in the field were suggested. A repre-

sentative of the Army Medical School who attended the meeting by invitation offered the facilities of his laboratories for cooperation on several of the problems, and pointed out that one of them was currently being investigated. The other six were then allocated to committees of volunteers from among those present for separate detailed consideration with a view to preparation of OSRD contract applications.

Activities of this kind could well be set up elsewhere and in other fields of science. They require only that a small group of persons in the field undertake the work of organization and the responsibility of seeing their work through to a fruitful conclusion. They should be encouraged, if not actively aided, by the scientific leadership of the country. Secrecy regulations are an obstacle to their progress, but not an insurmountable one. The details of many researches are necessarily secret, but the subject as a whole can generally be discussed openly without departing from the spirit of the regulations, and the gaps that require investigation can be indicated or sought by those in attendance. Cooperation such as the bacteriologists' group has received from informed persons who can help to eliminate duplication and to encourage useful projects is of the greatest value, and can probably be obtained with less difficulty than may be imagined.

There is encouraging evidence that this kind of volunteer activity meets a real need, both of the many individual scientific workers who are eager to participate in war research and will cooperate gladly in such an undertaking, and of those charged with the leadership of science in the war effort, who will recognize here a means to relieve themselves of part of their great responsibility, and to insure the more perfect fulfilment of the enormous task that has been assigned to them.

The fuller utilization of scientific resources implies more than research and more than the activities of scientific personnel. What of scientific work other than research? And what of the full utilization of scientific facilities, equipment and materials? The association has considered aspects of both questions.

Scientific workers who lack the facilities or the qualifications for war research can find work on the home front that makes use of their special skills, and which therefore can not be done by others not so qualified. They can aid in the training of civilian defense workers, or participate directly in local civilian defense organizations as gas detection experts, medical assistants or engineers for control or rehabilitation in disaster areas after enemy attack. They can prepare directions and help to institute precautions for storage or disposal of potentially dangerous materials in laboratories, factories and homes. Many scientists as individuals are now active in such work. The New York branch of the association is currently projecting plans for the more wide-spread utilization of scientific workers in such activities.

Scientists can also be of service by preparing pamphlets or books embodying popularizations of scientific data for the use of civilian defense workers and for education and morale-building among the armed forces. The Boston-Cambridge branch of the association has prepared a popular book on "Science from Shipboard" which is soon to be published by the Red Cross for distribution to soldiers aboard transports. Other branches are planning analogous books and pamphlets.

Sooner or later scientists will need to be concerned with problems that result from shortages of trained personnel on the home front. Aside from those means for overcoming shortages by rapid replacement through accelerated and improved education, means for substitution may also be available. A committee of the New York branch of the association has surveyed this problem as it affects the shortage of medical personnel in hospitals, and has considered the possibilities for substitution of technicians to perform many of the duties customarily undertaken by interns. Similar shortages may be expected to develop in civilian engineering activity, and may be met in part by parallel substitutions. Shortages of physicists, both in college teaching and in research, might be alleviated by substitution of workers in biology, chemistry and geology who have the necessary qualifications.[2c]

Another activity in which volunteer scientific effort can be used to good advantage to supplement centralized leadership is that of ensuring the full utilization of scientific facilities, equipment and materials. Shortages of metals and rubber and the conversion of industry to war production are rapidly making many types of apparatus unobtainable, and there are indications that other materials, such as certain organic chemical reagents, may soon disappear from the market. Critical shortages are bound to develop in some laboratories, while others either have the required equipment without using it or have the facilities for its production or synthesis. The National Registry of Rare Chemicals, maintained under the auspices of the Armour Foundation, grew directly out of the efforts of the Chicago branch of the association, and has become an important step toward the alleviation of one type of shortage, with a present listing of over three thousand items. A committee of the New York branch, cooperating with the committee designated for the purpose by the National Research Council, is now preparing local registries both of unused scientific equipment and of the need for unobtainable articles, as a basis for the necessary exchanges, perhaps by a "lend-lease" arrangement. This local effort, following and expanding plans

worked out by the Purdue branch of the association, is expected to provide a background of experience for a much more wide-spread survey that may soon become essential.

Beyond the goal of full utilization of scientific resources, in terms of the full-time employment in war work of all available personnel and materials, lies the problem of the most efficient utilization of these resources. Men and machines capable of more important war work than that being done may have to be converted further from the less to the more urgent tasks. One aspect of this problem has been mentioned in relation to the current shortage of physicians. Ultimately, as the exigencies imposed by total war become more and more apparent, and as the need for outright conversion of all science to war purposes is made inescapable, it may become imperative that all scientific activity be centralized and coordinated by a single government agency. A bill (S.2721) with essentially this purpose was introduced by Senator Kilgore on August 17, and has been referred to the Senate Committee on Military Affairs. The bill provides for a single government authority to survey, mobilize and coordinate all technological personnel and facilities of the nation for a maximum war effort. Certain changes in it appear desirable, particularly to remove its ambiguity with respect to the medical and biological sciences, and to insure continuity of the functions and adequate coordination of government agencies which now exist for the utilization of scientific resources.[3] It behooves all scientific workers to study this bill closely, since it affects their interests directly and embodies sweeping changes in their peacetime habits of life. If the "Office of Technological Mobilization" called for in the bill, or an analogous centralized government office of science, ever becomes a reality, the basis laid by expanded volunteer scientific work as outlined in this paper will take its place alongside the OSRD, the National Roster, and other official and semi-official government agencies as invaluable experience and as mechanisms in actual operation that may be expected to fit into the new centralized scheme with a minimum of alteration. All these efforts have their place in promoting the full utilization of scientific resources for total war. Volunteer effort, stimulated and guided from above, is not the least of them, and merits more attention as an essential part of this process of conversion of science to war than has heretofore been accorded to it.

SCIENTIFIC EVENTS

DEATHS AND MEMORIALS

DR. ARTHUR P. HONESS, professor of mineralogy and petrology at the Pennsylvania State College, died on October 17, at the age of fifty-five years.

DR. FRANZ C. SCHMELKES, assistant director of research of Wallace and Tiernan Company, Inc., manufacturers of pharmaceutical products and water-purifying apparatus, died on December 11. He was forty-three years old.

DR. MAX HARRISON DEMOREST, until recently instructor in geology at Wesleyan University, known for his researches in glaciology, according to information received from the War Department, died on November 30 in Greenland, where he was serving as a specialist with the rank of First Lieutenant at a remote military outpost. He was thirty-two years old.

PROFESSOR WILMOT V. METCALF died on November 21, at the age of eighty-two years. He had taught chemistry and physics at Whitman College, Carleton College, Fisk University and Berea College. His training included a bachelor's and master's degree at Oberlin College, the doctorate from Johns Hopkins, a year's post-doctorate study at Wurzburg and two years at Leipzig. In 1917, after persistent but unsuccessful efforts to enlist at the age of fifty-seven years, he volunteered for service with an ambulance unit and served for a time in France, paying all his own expenses. Later he served with the Army Y.M.C.A., his special interest being in personally delivering Y.M.C.A. supplies to the boys in the front-line trenches. Professor Metcalf's professional field was physical chemistry. Early in life he became interested in the philosophy of science. He was studying zealously in that field at the time of his death, having maintained a wide correspondence on the subject and contributed a number of papers to scientific and philosophical magazines in recent years. Professor Metcalf was the older brother of Maynard M. Metcalf, the zoologist, who died in 1940.—LLOYD W. TAYLOR.

A CORRESPONDENT writes: Robert Peele, who died at his home in New York City on December 8, in his eighty-fifth year, had been emeritus professor of mining of Columbia University since 1925 and a member of its staff since 1892. A graduate of the School of Mines with the class of 1883, after ten years of varied professional experience in the United States and South America, he was appointed adjunct professor in 1892

[3] Since this paper was presented, another bill has been introduced by Representative Tolan and by Senators Kilgore and Pepper. The Tolan-Kilgore bill embraces provisions similar to those of the original Kilgore bill, but as part of a broad program for total mobilization of the nation's manpower and resources. The modifications in the Kilgore bill referred to above have been largely included in the newer bill.

and made full professor in 1904. His many former students will remember him best for his conduct, for thirty years, of the supervised and directed summer school work in the field, where he trained them in accurate analysis and observation, and the precise recording of data. He published his two books, "Compressed Air Plant," 1908, and "The Mining Engineers' Handbook," 1918, both of which have gone through several subsequent editions. He was awarded the gold medal of the Mining and Metallurgical Society of America in 1922, the Egleston Medal of the Engineering Alumni Association of Columbia University in 1939, and was made an honorary member of the American Institute of Mining Engineers in 1935.

A WIRELESS dispatch from London under date of December 13 to *The New York Times* reads: "Tercentenary observances of the birth of Sir Isaac Newton were begun to-day at Grantham, near the peaceful hamlet of Woolsthorpe-by-Colsterworth, where the scientist was born. As townspeople and others, including Sir Henry Dale, president of the Royal Society, looked on, a laurel wreath was laid at the foot of Grantham's statue of Sir Isaac, which has been denuded of ornamental railings formerly surrounding it. The honor of laying the wreath fell to a youngster named J. H. Foster, head boy of King's School, where Newton received his early education. Newton's birthday was Christmas Day, 1642, but so many observances had been planned that it was decided to start them to-day. At church services at Grantham this morning, the Right Rev. A. A. Markham, of Stoke Rochford, Bishop of Grantham, offered special prayers 'in thankful remembrance of Isaac Newton' and 'for the right use of science.'"

THE BRITISH TECHNICAL ADVISORY COMMITTEE ON NUTRITION

THE work of the first meeting, recently held in London, of the British Technical Advisory Committee on Nutrition to investigate the post-war nutritional needs of European countries overrun by the Axis nations, is reported in *The Times*, London.

The Nutrition Committee is one of five technical advisory committees which work in conjunction with the Allied Post-War Requirements Bureau, the organization set up as a result of the St. James's Palace conference of September 24, 1941.

At an early stage the bureau set up a technical advisory committee on agriculture under the chairmanship of Sir John Russell, director of the Rothamsted Experimental Station. This committee has already completed a report on seed requirements needed in Europe after the close of hostilities, and is now investigating the problems of restoring live-stock herds, training tractor drivers, supplying agricultural machinery and estimating likely fertiliser needs.

Within the past few weeks other technical advisory committees have been set up to deal with such matters as inland transport and medical needs. The committee is composed of transport experts of those allies who are most intimately concerned with post-war conditions in Europe.

The medical committee has decided upon a basic list of 59 drugs, showing the total quantities required per 100,000 of population for the first month after liberation. Further lists for those special areas where diseases are endemic or epidemic are now under consideration.

It has been realized from the outset that considerable help in the bringing of relief to occupied regions can be given by British and international voluntary societies, and the bureau maintains close contact with a Consultative Council on which such voluntary societies are represented.

RURAL LAND USE

COMPREHENSIVE programs of post-war public construction to conserve and improve rural lands are outlined in "Public Works and Rural Land Use," a report transmitted to the President by the National Resources Planning Board, recently made public. The board in its letter of transmittal said:

> The importance of this statement at this time lies in the clear indication which it provides of the needs and possibilities for activity after the war to develop these basic resources. We hope the report may stimulate the preparation now of plans for rural works of tested merit which can be undertaken when the war is won.
>
> Although the report is not primarily concerned with public land acquisition, it does contain a discussion of public land acquisition as one of the effective tools for facilitating land-use adjustment. It is noted, for example, that of the 1,900,000,000 acres of land in Continental United States 415,000,000 acres are classified as crop land, of this crop land total 339,000,000 acres or 82 per cent. are suitable for cultivation under appropriate soil conservation practices, and the remaining 76,000,000 acres are classified as land which could not be cultivated safely and profitably under normal prices. Our policy with respect to rural public works must therefore take into account the following:
>
> (1) Promotion of those public works and undertakings required to conserve and improve crop lands suitable for cultivation, forest lands and range lands.
>
> (2) Public acquisition of submarginal crop lands and their conversion to more suitable land uses.

This report, which forms a part of the National Resources Planning Board program of post-war planning was prepared under the direction of the Land Committee of the board, by representatives of construction agencies in the Department of Agriculture and by the Department of the Interior. It consists of five statements, covering public construction on

agricultural, grazing, forest, recreational and wildlife lands. Each statement outlines the general objectives of the program of land conservation, development and economic use in the field covered, indicates the types of public works which contribute toward accomplishment of this program and sets forth certain standards for evaluating individual works projects of various types.

THE COLLEGE OF MEDICINE OF THE UNIVERSITY OF ILLINOIS

CHARGES that the University of Illinois had deteriorated during the past eight years as the result of political activity by the board of trustees resulted in action by the board at its June, 1942, meeting inviting the American Council on Education and the American Medical Association to investigate the university. The American Council on Education has not yet reported, but the American Medical Association has submitted an elaborate report after an exhaustive study of the College of Medicine. According to this report,

> the College of Medicine is an integral part of the University of Illinois, a state-owned institution, controlled by an elected board of trustees, of which Dr. Karl Meyer, Chicago, is president. There is apparently being effected a rather progressive reorganization of the curriculum which promises much more satisfactory clinical training during the third and fourth years than was possible at the time of the last visit (1935). Members of the faculty, both preclinical and clinical, are in general outstanding and competent men who appear to be greatly interested in teaching, and it would appear that the heads of practically all the clinical departments recognize the need for additional clinical facilities under their immediate supervision.
>
> There is being developed in connection with the dental, medical and pharmacy schools, correlated, cooperative and even integrated teaching programs. The school is to be commended for undertaking this interesting experiment which should be a real contribution to professional education.
>
> Further developments are currently being effected or studied and these promise to offer unusual opportunities in the fields of both undergraduate and graduate medical education.
>
> The physical plant for the preclinical departments is apparently satisfactory, and the departments of pathology and bacteriology which were very unsatisfactorily housed at the time of the previous visit now have satisfactory quarters.

Dr. Raymond B. Allen, executive dean of the three Chicago colleges of the University of Illinois, is reported to have said:

> In no important particular has the report brought forth any facts or conclusions about which the university has been unaware or about which something has not or is not being done. Many of the suggestions for further improvement must await sufficient financial aid. Nevertheless, it is invaluable to have outside agencies express their unbiased, informed judgment as exemplified in this report.

THE SEMI-CENTENNIAL OF THE MEDICAL SCHOOL OF THE UNIVERSITY OF TEXAS

A SPECIAL war program for the Semi-Centennial graduation exercises of the University of Texas Medical School, Galveston, was held on December 18. At the morning session Dr. Chauncey D. Leake, dean and vice-president, welcomed those in attendance with a discussion on the medical responsibilities of war. Dr. E. H. Cary, professor of oto-rhino-laryngology at the Baylor University Medical School, Dallas, past-president of the American Medical Association, spoke on "The Role of the Specialist in Military Medicine," and Dr. I. S. Ravdin, Lieutenant Colonel, M.C., professor of surgery at the University of Pennsylvania, gave an address entitled "A New Era in Military Surgery." At the afternoon session, Dr. C. C. Sturgis, professor of medicine at the University of Michigan, discussed blood and substitutes in shock. A survey of wound healing was given by Dr. Alton Ochsner, professor of surgery at the Medical School of Tulane University. Dr. F. G. Ebaugh, Lieutenant Colonel, M.C., professor of psychiatry at the Medical School of the University of Colorado, spoke on "Psychiatry and War." The scientific session was concluded by a consideration of "Obstacles in the Path of an Optimum Diet," by Dr. A. J. Carlson, Hixson distinguished service professor of physiology of the University of Chicago. At the graduation exercises in the evening, Dr. Judson L. Taylor, Lieutenant Commander, M.C., president of the Texas State Medical Association, will give the address. Honor guests on the occasion will be Dr. Edward Randall, professor of therapeutics emeritus, and Dr. Seth M. Morris, professor of ophthalmology emeritus, who are two living members from the original faculty of the school.

SCIENTIFIC NOTES AND NEWS

IGOR I. SIKORSKY was presented on December 7 with the Sylvanus Albert Reed Award for 1942 of the Institute of the Aeronautical Sciences. It carries an honorarium of $250 and is made annually for "a notable contribution to the aeronautical sciences whose practical value is apparent." The award was made in recognition of work on "the creation and reduction to successful practice of a helicopter of superior controllability." The presentation was made on the same occasion as the delivery by Edmund D. Allen of the

sixth annual Wright Brothers Lecture at Columbia University, which provides the sum of $250 for the lecturer.

THE American Pharmaceutical Manufacturers' Association presented its annual award of distinction on December 7 to Dr. Edward A. Doisy, of St. Louis University, "in recognition of his isolation in pure form of the female sex hormone estrone (theelin) and his other valuable contributions to knowledge of estrogenic substances important in therapy and research." Dr. Torald S. Sollmann, dean and professor of pharmacology and materia medica at the School of Medicine of Western Reserve University and chairman of the council of pharmacy and chemistry of the American Medical Association, made the presentation address. It was entitled "Those Busy Hormones." Other speakers and their subjects were: Dr. George R. Cowgill, associate professor of physiological chemistry at the School of Medicine of Yale University, hormone developments; Dr. Oscar Riddle, of the Station for Experimental Evolution of the Carnegie Institution at Cold Spring Harbor, N. Y., hormone therapy, and Dr. Ephraim Shorr, associate professor of medicine at Cornell University Medical College, the future of hormone therapy. Dr. Doisy, in reply, gave a brief history of his experiments.

DURING the convocation of the University of Chicago, Katharine Lenroot, chief of the Children's Bureau of the Department of Labor, was presented with the Rosenberger Medal "for notably great service in the promotion of human welfare."

THE Council of the British Royal Meteorological Society has awarded the Buchan Prize for 1943 to Dr. T. E. W. Schumann and Gordon Manley.

DR. GEORGE D. STODDARD, Commissioner of Education of the State of New York, previously dean of the Graduate College and director of the Child Welfare Station of the State University of Iowa, was awarded the honorary degree of doctor of laws at the commencement exercises on December 13 of Hobart and William Smith Colleges, where he delivered the Phi Beta Kappa address.

DR. LEWIS SELKIRK COONLEY, associate professor of chemical engineering at the Rensselaer Polytechnic Institute, has been made chairman of the department. He succeeds Dr. Albert Watson Davison, who has been named director of research for the Owens-Corning Fibreglas Corporation.

SIR J. DONALD POLLOCK, Bt., M.D., has been reelected rector of the University of Edinburgh.

DR. THOMAS T. READ, Vinton professor of mining engineering at Columbia University, has been appointed consultant in the education and allocation of engineers in the office of the director of operations of the War Manpower Commission.

DR. JOHN G. BROUGHTON, of Rome, N. Y., has been appointed to the newly established position of assistant state geologist of New York.

DR. NORBERT FELL, who joined the Research Staff of Parke, Davis and Company in 1936 as a biochemist and subsequently developed a research division devoted to immunochemistry, has been promoted to the position of director of the department of biological manufacturing.

DR. HERALD R. COX, formerly principal bacteriologist of the Rocky Mountain Laboratory of the U. S. Public Health Service, Hamilton, Mont., has joined the staff of the Lederle Laboratories, Pearl River, N. Y., as associate director of research in charge of virus and rickettsial diseases.

LORD ONSLOW has resigned the presidency of the Zoological Society, London, for reasons of health, and Henry Gascoyen Maurice has been elected president until next April.

THE Earl of Moray and J. M. Bannerman have been appointed members of the British Forestry Commission in succession to Sir John Sutherland, who has submitted his resignation.

A COMMITTEE under the chairmanship of Dr. Henry Lewis Guy, engineer of the mechanical department of the Vickers Company, was recently appointed by the British Minister of Supply to review machinery for the conduct of research, design and experimental work in connection with the development of guns, small arms and ammunition. As a result of the committee's recommendations, the Minister of Supply has appointed Professor John Edward Lennard-Jones, F.R.S., Plummer professor of theoretical chemistry at the University of Cambridge, to be chief superintendent of armament research, and F. E. Smith, of Imperial Chemical Industries, Limited, to the post of chief engineer and superintendent of armament design.

DR. H. S. SOUTTAR, chairman of the Council of the British Medical Association and chairman of the Central Medical War Committee, has been made chairman of a mission to report on the medical services for the armed forces in India. During his absence Professor R. M. F. Picken has been appointed acting chairman of council.

DR. WALTER PATRICK, professor of physical chemistry at the Johns Hopkins University, gave on December 11 the annual Alpha Chi Sigma lecture in chemistry at Syracuse University. The lectureship was established with the purpose of bringing back

to the university each year a distinguished alumnus in chemistry. Dr. Patrick spoke on "The Hydration of Ions."

Dr. Carey Croneis, professor of geology at the University of Chicago, during the interim between November 27 and December 7 addressed the local geological societies at Centralia, Ill.; Wichita, Kans.; Tulsa, Okla.; Dallas, Ft. Worth, Midland, San Antonio and Houston, Texas; and Shreveport, La., on "Geological Warfare," as a part of the distinguished lecture program of the American Association of Petroleum Geologists.

Dr. William Cramer, of the Barnard Free Skin and Cancer Hospital, St. Louis, delivered on December 2, at the University of Missouri, a lecture on "Cancer as a Biological Problem" at a meeting of the Missouri Chapter of the Society of Sigma Xi.

On October 27, Dr. Hilton A. Smith, professor of chemistry at the University of Tennessee, addressed the Sigma Xi Club of the University of Tennessee and the East Tennessee Branch of the American Chemical Society on "Catalytic Hydrogenation." On December 1, Dr. Dorothy E. Williams, nutrition chemist at the Agricultural Experiment Station of the University of Tennessee, spoke on "Phosphate Nutrition Research."

Professor A. H. Reginald Buller, professor emeritus of botany at the University of Manitoba, recently gave two public lectures at Cornell University on the Jacob H. Schiff Foundation. The subjects of the lectures were "The Sexual Process in the Rust Fungi (Uredinales)" and "Recent Discoveries Concerning the Bird's Nest Fungi (Nidulariaceae)."

A dinner in honor of Alfred Nobel, founder of the Nobel Prizes, who died in 1896, was held in New York on December 10. The speakers included Pearl Buck, Dr. Harold C. Urey, Thomas Mann and Norman Angell.

It is announced that by vote of the executive committee, the Federation of American Societies of Experimental Biology, which includes the American Physiological Society, the American Society of Biological Chemists, the American Society for Pharmacology and Experimental Therapeutics, the American Society for Experimental Pathology, the American Institute of Nutrition and the American Society of Immunologists, will omit the meeting which was scheduled to be held in Cleveland from April 6 to 10, 1943. This action applies only to the federation as such and does not cover any meetings which may be organized by the constituent societies. It is further announced that provision will be made for publication in the Federation Proceedings of abstracts of such papers as would have been offered for presentation if a federation meeting had been held or which may be offered for presentation at meetings of the constituent societies. These abstracts will be received by the secretaries of the constituent societies in the customary manner according to notices to be sent to the memberships.

The annual meeting of the American Association of University Professors, scheduled for December 28 and 29 in Cleveland, Ohio, has been cancelled. This action was taken in compliance with a request from the Office of Defense Transportation. Election of council members and voting on pending constitutional amendments will be conducted by mail. Ballots for this purpose will be sent to members early in January.

The Experiment Station Record reports that the Kansas State College Research Foundation has been organized, with President F. D. Farrell as chairman of a board of nine directors. Its charter is said to follow closely those of like organizations at a number of land-grant institutions.

Dr. E. D. Merrill, director of the Arnold Arboretum and administrator of botanical collections, Harvard University, has nearly completed a special emergency food manual for the War Department, covering the Polynesian, Micronesian and southwestern Pacific areas. This will later be extended to cover the entire Malayan region. The task was undertaken at the request of the War Department through the National Research Council. The tender stems, leaves, flowers, fruits, seeds and underground parts of a great variety of native and introduced species are currently used by the natives of the regions covered, to supplement their daily diet. A selection of the more common and widely distributed species, with illustrations, simple statements covering the parts used, special methods of preparation where indicated and the habitats in which the species occur indicates its scope.

An American Standard governing letter symbols for mechanics of solid bodies has been approved and published by the American Standards Association. In addition to the sixty-eight letter symbols approved to indicate such concepts as angular acceleration, circular frequency, factor of safety, normal strain, wavelength and the like, the new standard cites general principles of letter symbol standardization governing manuscripts, subscripts, superscripts, unlisted magnitudes and typography. The new standard was prepared by the Sectional Committee on Letter Symbols and Abbreviations for Science and Engineering, under the joint technical leadership of the American Association for the Advancement of Science, the American Institute of Electrical Engineers, the Ameri-

can Society of Civil Engineers, the Society for the Promotion of Engineering Education and the American Society of Mechanical Engineers.

THE Buenos Aires correspondent of the *Journal* of the American Medical Association writes: "The scientific relations between Argentina and Brazil are close. Groups of physicians of each country make visits to the other country for the exchange of scientific knowledge. Books of Brazilian medicine have been recently translated into Spanish under the honorary direction of Dr. Mariano Castex, professor of clinical medicine of the Faculty of Medicine of Buenos Aires, and under the active direction of Dr. Egidio S. Mazzei and Elyeser Magalhaes. The volumes of this collection have been translated into Spanish with the aim of enabling Spanish-speaking physicians to know some of the most important books of their Brazilian colleagues. Dr. José Silveira's book, 'Atelectasia y Tuberculosis Pulmonar,' is the first one of this collection to be translated. Three other books are going to be translated and published in the near future: (1) 'Enfermedades del Hígado: Diagnóstico, Patologoa, Terapéutica,' by Dr. Clementino Fraga; (2) 'Aneurismas Aórticos,' by Dr. A. de Almeida Prado, and (3) 'Propedéutica Radiológica,' by Professor Manuel de Abreu. All these books are edited by the publishing house 'El Ateneo' of Buenos Aires."

The Times, London, reports that as a gesture of appreciation from British doctors to their colleagues in Russia a book containing articles on British war medicine has been prepared by the Anglo-Soviet Medical Council. The council held a reception in London on November 23, when Madame Maisky was presented with the book and the Honorable Ivor Montagu spoke on "Scientific and Educational Films in the U.S.S.R."

DISCUSSION

SORA, NEAR-VICTIM OF A FISH

ON September 15, 1942, an immature male specimen of sora (*Porzana carolina*) was transmitted to the New York State Museum by Vernon Haskins, of East Durham, Greene County, New York. This bird was recovered from the highway near his home, where evidently it had been struck by a passing automobile the preceding night. The carcass was intact and examination of the internal organs revealed only slight trauma and bleeding with the skeletal parts in perfect condition. Measurements in millimeters are as follows: length, 203; wing, 109; tail, 53; tarsus, 29; bill, 19. The bird was very fat and weighed 73.4 grams.

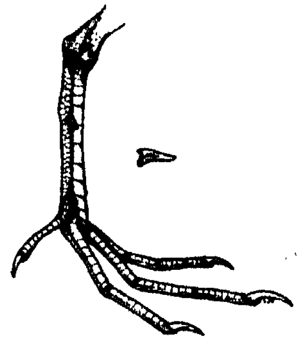

FIG. 1. Left tarsus of sora showing position of the fish tooth; also a lateral view of the tooth itself. About two-thirds natural size.

Upon skinning the rail an interesting point came to light. One-half inch below the proximal end of the posterior aspect of the left tibio-tarsus a small, slightly curved and sharply pointed tooth-like structure had pierced both sides of the tarsal envelope and the contained tendon. The point of this foreign element had entered from the outer side of the tarsus and projected for a distance of about one millimeter beyond the inner tarsal covering. Hidden beneath the outer tarsal covering was the base of the element. Some slight discoloration marked its points of entrance and exit.

Removal and detailed examination of the offending foreign body revealed that it was the tooth of a fish, evidently a northern or some other species of pike (*Esox*). The broad base, shape, peculiar curvature, vertical basal striations and evident mode of insertion all provide evidence for this conclusion. The original length of this tooth was about 6 millimeters and the greatest basal width 1.5 millimeters; unfortunately, its extreme tip—perhaps one-half millimeter in length—was accidentally broken off at the time the tooth was extracted from the tarsus.

That the injury had been suffered not long before was evident from the still slightly blood-red internal appearance of the recently lost tooth and the fairly fresh condition of the rail's small leg wound. Since the tooth either had penetrated or abraded the tendon, it is possible that in walking the bird had suffered some slight inconvenience or possibly pain.

One can only surmise the manner in which the tooth became thus embedded in the leg of the rail. It is well known that pike are voracious feeders with carnivorous proclivities. The available evidence suggests that the bird while walking in the water may have been set upon by one of these fish which scored only a "near miss" for its efforts. Later, the rail suffered an even more ignominious end as the victim of a speeding motor car.

The sora here discussed is now included in the

zoological exhibit collections of the New York State Museum, Accession No. 6342.

Dayton Stoner
Louis J. Koster

New York State Museum,
Albany

THE TROPICAL CHIGOE IN CALIFORNIA

Tunga penetrans (Linnaeus), a tropical and subtropical siphonapterous pest, commonly known as chigger, jigger, chigoe or sand flea, has heretofore remained unreported as adult from the continental United States,[1] except for one case from New Orleans.[2] Thirteen gravid females[a] were recently (April 7, 1942) recovered from the eyelids of a Pacific horned owl (*Bubo virginianus pacificus* Cassin), at Oceanside, San Diego County, California, by Kenneth Stager.

The life history and etiology of this flea[3] are of special interest in the present emergency. Its habitat is essentially warm, dry, sandy places. Although considered free living as larvae (with the one reported exception[2]), adults attack not only birds, but also other warm-blooded animals, including man. Though not known to be a vector of pathogenic organisms, its entry beneath the epidermis and invasion of the stratum lucidum produces irritating skin ulcers which are frequently complicated by secondary invaders.

Southern California is known to have many outdoor camping grounds. Camp directors should therefore be on the alert for its possible appearance in infested areas. Also, with the erection of many open-air military camps in the southwest, it seems particularly desirable that special studies as to the distribution in this country be made, and precautions taken to prevent its spread.

G. F. Augustson

Allan Hancock Foundation,
University of Southern California

ON NUMBERING BOOK ILLUSTRATIONS

I am reading a book on meteorology, and I come upon this sentence, "Fig. 50b shows the typical features of a towering cumulus (see also Fig. 25)." Now Fig. 50b is right under the eye; but Fig. 25? Evidently it is somewhere in the fore part of the book. I am at page 81, and I make a chance dive into the earlier pages and come upon page 47. It happens to carry Fig. 32. So I thumb my way back page by page until I come to Fig. 25 on page 32. This happens to be a small book; in one of 600 pages it would be a longer chase. Now this all takes time, interrupts the attention and, with me, gives rise to an emotional turbulence which may eventuate in profanity. I am sure that many others have had the same experience, barring perhaps the emotional turbulence. "A law ought to be passed," not against the use of profanity under such circumstances, but against the use of a separate series of numbers for illustrations.

For there is no logical reason for a separate numbering of the illustrations. They are not regularly spaced as are the pages. One can not at once turn to a numbered figure in a distant part of the book, as he can to a numbered page. Their use is time-consuming and irritating.

Besides, there is a better way of handling the matter. Figures in the text should be referred to by their page number. Fig. 25, above, would then be Fig. p. 32; or even Fig. 32. One could then turn to it at once. If there were more than one figure on a page they could be distinguished as A, B, C, etc.

This suggestion concerns especially text-books in physical science and technology. It is addressed to the writers and publishers of such books. It is the duty of author and publisher to reduce the effort of the reader in every possible way; and here is one way. Any unnecessary taking of the reader's time and energy is larceny, stealing; is immoral.

Some of the best texts are already dropping the serial numbering of figures. Smith and Phillips's splendid "North America" (Harcourt, Brace and Company) is one: it omits the numbers, and when there is more than one illustration on the page it distinguishes them by letters. The use of the old system of consecutively numbered figures hangs on because of inertia and lack of imagination. Writers of textbooks on science ought to be able to climb out of this rut.

Lewis G. Westgate

SCIENTIFIC BOOKS

TOPOLOGY

Algebraic Topology. By Solomon Lefschetz. vi + 389 pp. Vol. 27. Colloquium Publications of the American Mathematical Society. 1942. $6.00.

Analytic Topology. By G. T. Whyburn. x + 278 pp. Vol. 28. Colloquium Publications of the American Mathematical Society. 1942. $4.75.

These two mathematical volumes, written by lead-

[1] I. Fox, "Fleas of Eastern United States," p. 12. Iowa State Coll. Press, Ames, Iowa, 1940.

[2] E. C. Faust and T. A. Maxwell, Report of a case, Arch. Dermat. Syph., pp. 94–97, 1930.

[3] P. H. Manson-Bahr, "Manson's Tropical Diseases. A Manual of the Diseases of Warm Climates." Eleventh edition. Williams and Wilkins Company, pp. 700–703, 1940.

[a] After proof was received, a communication (in litt.) from the U. S. Health Service in Montana suggests this might be *Hectopsylla psittaci*, a nearly related flea from South America. Without males certain identity is difficult.

ers in their respective fields of algebraic and analytic topology, constitute another notable addition to the series of Colloquium Publications of the American Mathematical Society. There has been an extensive forward movement in the field of topology (formerly called "analysis situs") during the present century, in which Russian, Polish and American mathematicians have played a conspicuous part. In all probability these two volumes represent a kind of culmination of the abstract phase in this development.

The scientific public has for some time been aware of the abstract character of much of contemporary mathematics; this has tended to make of their mathematical colleagues a class somewhat apart. The exceeding generality of the ideas involved and the extremely technical and abbreviated terminology employed have been annoying at times, especially to those who believe that the specific situations, which arise naturally, are supremely important and that all really important ideas are basically simple. The answer to such individuals must be that the concrete intellectual object is merely the final definitive form of an abstraction, as illustrated for example by the integer; and that a "simple" concept is only one with which we have become familiar through long use, as, for instance, that of energy in physics.

It appears then that the really significant questions are whether or not topology has attained its approximately definitive abstract form and whether topological concepts are going to prove widely useful. I believe that most mathematicians who know something of the recent work would answer the first question in the affirmative. Moreover, the broad notions of "topological space" and of "metric space" which are given first consideration in both of the volumes deserve to become as well known to the scientific world as that of "linear vector space" of which ordinary Euclidean space serves as the familiar prototype. The "additive group," illustrated by ordinary and angular numbers, is likewise of prime importance. This basic concept of an additive group (in a topological space) is central in algebraic topology and has been much illuminated by the remarkable work of the Russian mathematician Pontrjagin, a good deal of which appears in Lefschetz's book in convenient form.

Broadly speaking, algebraic topology develops the algebraic machinery involved in the dissection into "complexes" and the characterization of the connectivities and other intrinsic properties, of geometric entities—lines, surfaces, solids, etc.—such as are found in ordinary Euclidean space of two or more dimensions. These are regarded only qualitatively, so that a sphere and ellipsoid are not distinguished, while a ring would be regarded as fundamentally different from a sphere. In algebraic topology the basic ideas of "homology" and "homotopy" are derived from that of continuous deformation: thus a small circle on a sphere is said to be homologous to 0, since it can be deformed continuously to a point.

The technical algebraic apparatus involved in homology and homotopy theory was in large part envisaged by Henri Poincaré in his classical five articles on analysis situs (1895–1904). Oswald Veblen through his excellent Colloquium Lectures on "Analysis Situs," published in 1922 and reprinted in 1931, presented the ideas of Poincaré in accurate, improved and suggestive form, and so performed a valuable service for the mathematical world; one recalls also the very useful earlier article by Dehn and Heegard on the same subject in the German Mathematical Encyclopedia. In this way interest was aroused here and abroad. Veblen's work and inspirational influence may properly be regarded as forming the starting point of the many important American contributions to algebraic topology. Lefschetz, with earlier topological investigations to his credit in the field of algebraic geometry, has done much to advance the purely algebraic side of topology.

But while all the abstract focal points involved in algebraic topology have been most successfully highlighted by means of the abstract method in the newer developments presented in Lefschetz's book, one fact needs to be emphasized: the classical open questions noted by Poincaré and others have been left largely untouched. Lefschetz, in referring to the "Poincaré group,"[1] conjectures (p. 310) that "ignorance concerning this group seems to account for the fact that many of the major problems of topology have so far eluded all attempts at solution." It probably has been J. W. Alexander and, more recently, Hassler Whitney who in this country have most advanced toward the solution of such unsolved specific questions. The appearance of Hassler Whitney's forthcoming book on "sphere spaces" will for that reason be awaited with especial interest.

On the other hand, the pure abstractionists have performed beautifully the essential task of giving topological ideas their appropriate abstract setting, and this has been work of the first order of importance.

The volume of Lefschetz owes much to the effective collaboration of various workers in the field and shows the happy effect throughout. Lefschetz mentions especially Samuel Eilenberg, W. W. Flexner,

[1] Typified in the simple case of the circle by the k-fold circuits. Thus a minute-hand makes in one hour one circuit ($k=1$), and makes 24 circuits in a day ($k=24$). Here enters characteristically the "additive group" of the integers in an elementary question of algebraic topology.

N. E. Steenrod, John Tukey and Claude Chevalley. At the end appear two valuable Appendices, one on "homology groups" by Samuel Eilenberg and Saunders MacLane, and the other on "periodic transformations" by P. A. Smith. Both this book and Whyburn's are practically flawless in typography. The earlier volume written by Lefschetz in the Colloquium series ("Topology," 1930) may be regarded as more or less superseded by the new work under review.

The general plan of the book by Lefschetz is roughly the following: general spaces and additive groups (Chapters 1, 2) complexes and nets of complexes (Chapters 3–6), general homology theory (Chapter 7), topology of polyhedra (Chapter 8). Both of the excellent introductory chapters will be carefully read by a very wide circle of mathematicians. In Chapter 3, the approach to the basic theory of complexes is that of A. W. Tucker. The Czech "homology theory" of topological spaces is made fundamental, of which the Alexander-Kolmogoroff, Alexandroff, Kurosch, Lefschetz and Victoris theories appear as specializations. The fundamental work of Alexander and Pontrjagin, extending the Poincaré principle of duality, and that of Lefschetz on intersections, coincidences and fixed points, is developed in the later chapters.

The reviewer has seen at least one attribution in the volume of Lefschetz which appears to him to be unsatisfactory, even if it has been widely accepted, namely calling "theorem of Zorn" (p. 5) a result which, as Lefschetz states, had been essentially given by R. L. Moore earlier.[2] It seems to the reviewer that the theorem would be more appropriately designated the "theorem of Moore-Zorn."

The interest in general types of spaces, important alike for algebraic and for analytic topology, began with the thesis of Fréchet (1905) in which "metric spaces" were defined and studied. Stimulated by this work and that of Hilbert and of Erhard Schmidt, E. H. Moore, the outstanding American mathematician of his day, conceived of absolutely general spaces in which the elements (points) might be of wholly arbitrary type. A little earlier he had been interested in the foundations of geometry and other logical questions. At that time there were working at Chicago with E. H. Moore a group of extremely able young men, among them Veblen, R. L. Moore and N. J. Lennes. The subsequent role of Veblen in the development of algebraic topology at Princeton has already been mentioned. R. L. Moore was destined to become the creator of the important American school in analytic topology at Austin, with G. T. Whyburn and R. L. Wilder as outstanding students and co-workers among an important group. Veblen, R. L. Moore and Lennes had nascent ideas in the field now called analytic topology, which treats largely of connectedness and continua in topological space, where "point" and "neighborhood of a point" constitute the only primitive ideas. For example, Lennes proposed about that time to define a simple arc AB as a closed[3] connected set of points containing A and B which contains no closed connected subset likewise containing A and B.

A very important later idea of R. L. Moore which finds its proper place in Whyburn's book is that of "upper semi-continuous collection." Imagine the ordinary Euclidean plane to be constituted of closed continua, U_P, one and only one containing an arbitrary point P. Suppose further that if the point P tends to a point Q, then always U_P tends toward all or a part of U_Q. The collection of sets U_P then constitutes an *upper semi-continuous collection* in the sense of R. L. Moore. This idea has dynamical applications as I have found, although, interestingly enough, it was invented by Moore simply as a mathematical *jeu d'esprit*, by the esthetic combination of ideas.

The general plan of the book by Whyburn is roughly the following: Introductory topology (Chapter 1), mapping theorems (Chapters 2, 8–11), theorems on connectedness (Chapters 3–6) upper semi-continuous collections (Chapter 7), periodic transformations and fixed points (Chapter 12). A considerable portion of the book is devoted to advances made by R. L. Moore and by Whyburn. Being slightly less condensed and involving a less extensive range of ideas, this book makes easier reading than that of Lefschetz.

It is significant that both volumes terminate with a discussion of "fixed point theorems." A very simple example of such a theorem is furnished by the continuous mapping of a linear segment AB of a line on part of itself, as A′B′. It is clear that as a point P travels from A to B, its image P′ passes from A′ to B′, and coincides with or intersects P in a "fixed point" an odd (or infinite!) number of times, since P passes P′ in one sense k + 1 times and k times in the other (negative) sense. Thus we have

$$(k+1)+(-k)=1.$$

As the Dutch mathematician L. E. J. Brouwer and others noted long ago, there is a very general type of geometric situation in which the algebraic sum of the intersection numbers (Kronecker indices) is unique and determinate, regardless of all internal details. Hence it is only necessary to make the

[2] See, for instance, his notable Colloquium volume on analytic topology, "Foundations of Point Set Theory," 1932, p. 84.

[3] A point set is said to be "closed" if it contains all its limit points.

algebraic count of intersections in one special case to get the number of fixed points, algebraically taken. Lefschetz's well-known theorems on intersections, coincidences and fixed points describe situations belonging to this general category, of which various important special cases were previously well understood. The Appendix B by P. A. Smith with which Lefschetz's book closes is devoted to a study of the "Fixed Points of Periodic Transformations," a subject still closer to the dynamical applications. Similarly, the last chapter of Whyburn's book is entitled "Periodicity. Fixed Points," and references to the dynamical origins of this type of question are there made. Here Whyburn presents interesting work due in part to Kerékjártó, to Ayres, to Montgomery and to himself.

In this way one receives a concluding tacit suggestion in both cases that the abstract phase in the development of algebraic and analytic topology is about to pass into a second phase, less abstract and closer to basic dynamical ideas.

The significance of this rich mathematical source was realized first by Poincaré, who in the third volume of his celebrated "Méthodes nouvelles de la Mécanique Céleste" found it necessary to analyze the connectivity of certain manifolds of states of motion, to consider transformations and fixed point theorems and to evolve the concept of dynamical "probability." In fact it seems that *all* topological questions are presented naturally in purely dynamical contexts. Certainly there are numerous fascinating and important questions of this sort as yet unanswered. For example, questions concerning measure-preserving transformation (like rotations which preserve areas or volumes) are essentially topological in character, since these are the transformations which can not take any continua or set of continua into a part of themselves. As yet such "conservative" transformations have been little studied, although recently Oxtoby and Ulam have treated them to great advantage.

It seems to be regrettable that up to the present time so little has been accomplished by the topologists that is directly serviceable for application in the dynamical field. Since I have long worked in theoretical dynamics, on the borderland of and in what is essentially pure topology, I may be allowed to testify to this fact. More than any one else, it has been Marston Morse (see his Colloquium volume, "The Calculus of Variations in the Large," 1932) who has shown algebraic topology at work in the applications, through his notable "critical point relations." Likewise, as stated above, the upper semicontinuous collections of Moore in analytic topology have turned out to be valuable for the understanding of certain dynamical situations.

If further development in the direction of the applications continues, topology will indeed greatly increase in scope and significance. In any case, mathematicians generally will rely upon the books of Lefschetz and Whyburn, as representing the present high-water mark of topological development, and as furnishing first-hand and notable accounts of two basic aspects of abstract topology.

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SOCIETIES AND MEETINGS

CENTENARY OF THE AMERICAN ETHNOLOGICAL SOCIETY

THE centenary celebration of the American Ethnological Society, held on November 14, marked the founding of the oldest anthropological, and one of the oldest scientific, associations in the United States.

The society was founded in November, 1842, by Albert Gallatin, Secretary of the Treasury under Thomas Jefferson. Its headquarters have always been in New York, and it is now affiliated with the New York Academy of Sciences and the American Anthropological Association. The American Museum of Natural History in New York has consistently cooperated with the society. In 1943, the first year of the newly organized Inter-American Society for Anthropology and Geography, the society will likewise as an affiliate and council member of that group. nbership is at present largest for the United tes, but likewise includes individuals from Mexico, Central and South America and, until December 7, 1941, from Europe, India and the South Seas. It is noteworthy that a few English members still keep their accounts active.

The celebration was originally planned to cover at least two days and to include speakers from the country as a whole, but, at the request of the Office of Defense Transportation, it was telescoped into a single meeting terminated by a dinner, and its roster of speakers was limited to the eastern seaboard from Boston to Washington.

The afternoon meeting, held at the American Museum of Natural History, consisted of three sessions on the general topic of acculturation or culture-contact, oriented toward administration. One session was devoted to each of three geographical areas: Oceania, Latin America and North America. The speakers were Ruth F. Benedict, Raymond Kennedy, Clyde Kluckhohn, Ralph Linton, Margaret Mead and

Julian H. Steward. Discussants were A. Irving Hallowell, E. Adamson Hoebel, Frank Tannenbaum, George C. Vaillant, John Whiting and A. K. Widjojoatmodjo. The chairman was Wm. Duncan Strong, director of the Ethnogeographic Board. The papers will be published in full in the *American Anthropologist.*

At its centenary the American Ethnological Society passed the following resolution:

Be it resolved: that the American Ethnological Society, for 100 years dedicated to the study of peoples not belonging to Western Civilization, express upon the occasion of its centenary celebration its profound conviction that racial persecution and discrimination can not be scientifically justified. We protest the distortion of anthropology which falsely assigns inborn superiority to some one "race" and assigns others to inborn inferiority. Ethnological studies rouse enthusiasms for the inventions and social life of many peoples of all races and make it impossible to assent to the dogma that civilization depends upon the enslavement of one race by another.

The society was greatly honored at its centenary dinner by the presence of Albert Gallatin, great-grandson of its founder. The president, Harry Shapiro, presided. Albert Gallatin had also been instrumental in the establishment of New York University, and a congratulatory letter was read from the present chancellor of the university, Harry Washburn Chase. The society was also extremely fortunate in having as dinner speakers Clark Wissler, who served many years as secretary, president and director, and Franz Boas, who has been editor of the society's most important publication series since 1906, and to whom the society is indebted for its present organization along scientific lines.

Marian W. Smith,
Secretary

Columbia University

REPORTS

ANNUAL REPORT OF DR. JESSUP, PRESIDENT OF THE CARNEGIE CORPORATION

Dr. Walter A. Jessup, in his first annual report as president of the Carnegie Corporation of New York, announces that during the year 1941–42 grants totaling $2,831,650 were voted by the trustees "for the advancement and diffusion of knowledge." Of this sum, $533,565 was given for activities directly related to the war. The largest new grant made for war purposes, $100,000, has enabled the Joint Army and Navy Committee on Welfare and Recreation to conduct a variety of experimental programs as a basis for the activities of the Special Service Division of the War Department. Allocations amounting to $12,500 to the American Council on Education were made to keep colleges and universities informed of the personnel needs of defense agencies and, conversely, to inform these agencies of the manpower resources of educational institutions. Grants of $75,000 and $50,000 were also made to the Red Cross and the United Service Organizations, respectively, in support of their emergency activities.

President Jessup contrasts the present program of the corporation with that carried on during World War I:

The first World War came at a time when the Carnegie Corporation was hardly more than an institutionalized extension of Mr. Carnegie's personal philanthropy. Its administrative machinery was new and its program still in the making. Its direct contribution to that first great national crisis of the twentieth century took the form of generous gifts to outstanding private agencies which had undertaken to supply the amenities of life to men in the army camps. Appropriations to other Carnegie enterprises more actively concerned in the war effort and to the National Research Council were also voted in recognition of emergency responsibilities beyond their normal resources.

The present picture differs in many essential respects from that earlier one. In the first place, the Corporation in the period since 1918 has granted $140,800,000 to various agencies and institutions which share its concern for the advancement and diffusion of knowledge. Many of these agencies and institutions are now in a position to render direct and useful services to the Government. Secondly, the public has been educated to support the social service agencies which were the chief recipients of the grants made in 1917 and 1918, and they no longer look to the foundations for any substantial portion of their operating income. Finally, the very business of making war has changed. War now involves not only the professional soldier and the professional diplomat, but the scholar, the technician, the scientist, and the administrator as well. Success in modern war requires mobilization of all the nation's intelligence. In this kind of war, the foundation, which in the course of its normal peacetime activities has enjoyed peculiarly close relations with scientists and scholars, can play a useful role within the terms of established policies.

It has been interesting and on the whole encouraging to discover that by and large the research agencies and the professional associations which had come of age before the present war and with which the corporation has long cooperated are making substantial contributions to the war effort.

University and College Grants

Over a period of years, the corporation has contributed substantial sums for the development of

libraries and for study and research in colleges and universities. During the current year, three major grants were made to the following institutions: $150,000 to the new University Center in Atlanta, and $100,000 each to the Johns Hopkins University and to New York University. Development grants of $30,000 each were made to the universities of Maine and Vermont and to Colby and Southwestern (Tenn.) colleges, and a similar grant of $25,000 was voted to the University of the South. Commenting on these grants, President Jessup says:

> The war has created new problems for all American institutions, but few of them have suffered more stresses and strains than the university and the college. The budget-making of these institutions has been complicated by steady declines in enrolment. In certain fields, on the other hand, such as physics, chemistry, engineering, medicine and some of the social sciences, the difficulty of maintaining adequate teaching staffs has grown day by day. The attempt to revise regular programs to meet urgent Government demands for technically trained men has put a heavy strain on administrator and teacher alike. The skill and speed with which the colleges and universities have adjusted to all these new pressures have done much to justify the enormous investment of public and private funds which they represent. From coast to coast requests for instruction and for campus space in which to house soldiers and sailors during periods of special training have been met promptly, often at the cost of doubling already heavy teaching schedules and crowding regular students out of dormitories and fraternity houses.

For continuation of cooperative work with a selected list of graduate and undergraduate schools in developing criteria for admission and in providing a basis for judgment as to ability of those already admitted to candidacy for degrees, two grants totaling $65,000 were made to the Carnegie Foundation for the Advancement of Teaching.

Adult Education and the Arts

In the field of adult education the corporation voted the sum of $150,000 to the New York Academy of Medicine for the support of its services to the public and the medical profession, and $24,000 for continuation of the program of the Council on Foreign Relations in promoting discussion and study of international problems. Grants totaling $37,500 were made to the Canadian Association for Adult Education.

In the arts, a terminal grant of $48,000 was made to the Association of American Colleges for its program to bring to colleges and universities in small communities some of the cultural advantages of metropolitan institutions and to provide interchange of staff members. Also grants ranging from $2,500 to $15,000 were made to the Universities of Alberta, Nebraska, Virginia and Wisconsin, and to Vanderbilt University. Other grants included $30,000 to assure continuation of a music center as a division of the Pan American Union; $36,000 to the Metropolitan Museum of Art; and $20,000 to the New York Museum of Science and Industry.

Libraries and Research

Since its establishment in 1911, the corporation has granted some $30,000,000 or one sixth of its total income for library enterprises, in addition to the $43,000,000 given by Mr. Carnegie to help establish free public and academic libraries. With few exceptions, the 2,507 libraries made possible by these grants are now supported by the local communities which they serve. President Jessup states: "Every citizen, therefore, may take pride in the part which public libraries are playing in the war effort. In addition to organizing special collections on war information and civilian defense and providing up-to-the-minute reading lists, libraries in many cities have assumed the role of community centers, registering blood donors and air raid wardens, organizing forums and discussion groups, and providing reference service by telephone and mail for hard-pressed officials and businessmen."

The major grant for library interests during the current year, $75,000, was made to the University of Chicago Graduate Library School. Other grants included $25,000 for the development of the library of the Marine Biological Laboratory at Woods Hole, $10,000 in further support of the system of fellowships recently inaugurated by the Library of Congress; and a total of $55,800 to eleven technological colleges for rounding out book collections.

For general research, the Brookings Institution received $50,000 for support of its program, and the National Bureau of Economic Research grants totaling $55,000 for general support and for projects relating to the national emergency.

Except for the support of enterprises in the Dominion of Canada, no appropriations are being made by the trustees from the special fund created by Mr. Carnegie for work in the British Dominions and Colonies, because of the difficulties of administering and conducting projects during the war.

Three Decades of Giving

The report concludes with an analysis of a summary, made by the secretary of the corporation, Robert M. Lester, of total grants made by the corporation since 1911. During three decades the corporation has made gifts totaling almost $185,000,000, falling into three classifications: grants totaling more than $70,000,000 made to agencies or enterprises established by Mr. Carnegie, or growing from them, such

prevented by giving oxygen instead of air to breathe, at pressures of 380 and 190 mm Hg; and, second, the phenomenon occurs when the rats are given, at 760 mm Hg pressure, a mixture of 10½ per cent. O_2 and 89½ per cent. N_2 to breathe. These two experiments also show that pressure changes *per se* are not responsible for the negative water balances. Furthermore, it is probable that anoxia causes the phenomenon because of the hyperventilation which it induces. When rats were made to hyperventilate by giving them gas mixtures high in CO_2, keeping the O_2 constant at 21 per cent., a negative water balance of considerable magnitude is induced. Thus, with 5 per cent. CO_2, it was 5.1 cc per 100 gms of rat; with 10 per cent. CO_2, 4.7 cc and with 15 per cent. CO_2, 5.2 cc. These figures approach, but do not quite reach, the negative water balance of exposure to 380 mm Hg pressure (5.9 cc; see Table 1). Hyperventilation in effect passes more air over the evaporating surface of the lung and there results a greater water loss.

We feel that this negative water balance may be of importance in the etiology of pilot fatigue. The latter is postulated by Armstrong[1] to be closely related to adrenocortical insufficiency. In our opinion, the chain of events leading to this insufficiency is as follows: first, a water loss, as demonstrated here, and, second, a renal salt loss, due to the previous water loss[2] and to the relative alkalosis of acapnia.[3,4] Such a salt loss has been shown to occur in mountain climbers[5,6] and during exposures to low oxygen tensions.[7] It appears to be in some way mediated by the adrenal cortex.[7] The combined salt and water loss, unaccompanied by thirst, puts a considerable strain on the adrenals; if repetitive, it would tend to produce a subacute adrenocortical insufficiency. McCance[8] has described a somewhat similar situation in which great loss of body salt and water was unaccompanied by thirst. This resulted, in his experiment, in a condition simulating adrenal insufficiency and in a train of symptoms startlingly like those of pilot fatigue.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

DETERGENTS AND STAINING OF BACTERIA

IN order to obtain a satisfactory microscopic preparation of bacteria, in which cells are uniformly distributed, it is necessary to have slides which are thoroughly cleansed by chemical methods, flaming, or both. Otherwise, the high surface tension caused by the presence of fat-like substances on the surface of the slides produces an uneven and massed distribution of the bacteria.

In course of the routine laboratory work it has been found that satisfactory preparations could be made on slides which were cleaned mechanically from the dust particles with a piece of cloth, if to the suspension of the bacteria a small amount of a detergent was added. The following procedure gave satisfactory results.

Water solutions of "Aerosol OT" or a saline solution of "Aerosol MA"[1] 1:500 were kept at hand. One drop of one of those dilutions was placed with a loop on the slide. Bacteria were added from the liquid or solid media to this drop of detergent and the suspension was spread uniformly over the desired area with the loop. Preparations were air dried without heating, fixed with methyl alcohol or heat, and stained in the usual way. No detrimental effect of the presence of the detergent on the quality of the staining was noticed.

It was also found that the preparations made for the staining of the flagella gave the same results on the slides which were cleansed mechanically and the bacteria were suspended in distilled water containing "Aerosol OT" in the dilution 1:1000, as on the slides which were cleansed chemically and flamed with the bacteria suspended in distilled water alone. The quality of the flagella preparations was still better, however, when washed and flamed slides were used and the bacteria were suspended in the "Aerosol OT" solution. In such preparations the distribution of bacteria on the slides and the arrangement of the flagella were found most satisfactory.

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[1] H. G. Armstrong, "Aviation Medicine," Baltimore, 1939.

[1] Samples were kindly supplied by the American Cyanamid and Chemical Corporation.

[2] J. P. Peters, "Body Water," Springfield, Ill., 1935.

[3] Y. Henderson, SCIENCE, 49: 431, 1910.

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[5] G. Von Wendt, *Skand. Arch. f. Physiol.*, 24: 247, 1910.

[6] E. S. Sundstroem, *Univ. of Calif. Publ. in Physiol.*, 5: 121, 1919.

[7] R. A. Lewis, G. W. Thorn, G. F. Koepf and S. S. Dorrance, *Jour. Clin. Invest.*, 21: 33, 1942.

[8] R. A. McCance, *Lancet*, 1: 823, 1936.

A GRAVITY WRITING LEVER FOR RESPIRATORY TAMBOURS

THE superiority of tambours with gravity writing levers is quite apparent to all who have supervised laboratories in pharmacology or physiology. We have found a very simple and inexpensive modification of the Marey tambour to be a satisfactory substitute for the more expensive instruments now on the market.

The principle of the gravity writing arm is secured by making a simple carrier into which is fitted the ordinary writing arm in such a manner that gravity will hold it in contact with the drum. This carrier is made from a piece of 30-gauge metal (we use aluminum) about 1½ inches square, plus about 3 inches of 18-gauge

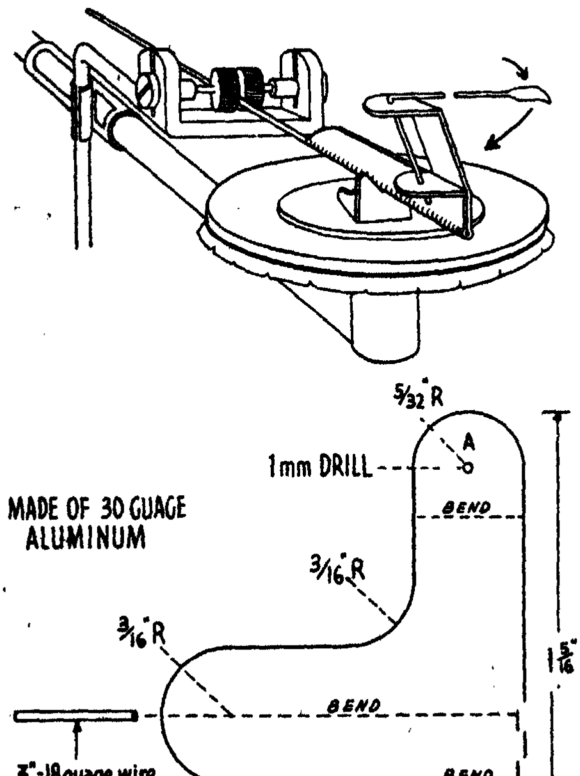

FIG. 1

wire. The figure shows the pattern for the carrier. The metal when thus shaped is folded over one end of the 18-gauge wire and crimped so as to hold. The wire is then placed in the spindle in the same manner as the old lever wire. The old writing arm is cut to the desired length and about one-half inch bent to nearly a right angle. The short arm of this right angle is inserted in the holes A and B, as shown in the figure. To adjust the swing of the arm to gravity it is only necessary to tilt the carrier a little toward the face of the drum. The pressure on the drum may be varied by the amount of tilt given the carrier and by increasing or decreasing the weight of the writing arm.

This slight modification of our stock of Marey tambours has enabled us to salvage a large number of them at a cost of but a few cents each, and at the same time obtain practically all the advantages of expensive tambours equipped with gravity writing levers.

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A FURTHER IMPROVEMENT IN THE HARVARD KYMOGRAPH

SUPPLEMENTING the three improvements in the Harvard kymograph already described,[1] the writer has made one change which has definitely improved the kymograph drum and solved the problem of cutting off the paper.

The aluminum drums of the Harvard kymographs become badly scratched by instruments used for cutting the paper until the surfaces are no longer smooth enough for careful work. The drums may be turned down on a metal lathe until they are perfectly smooth again and while still in the lathe a narrow, shallow groove may be cut across the drum directly opposite one of the four spokes just deep enough to take a few strands of thin copper wire. A hole is then drilled one half inch from the groove into the spoke at both ends of the drum with a number 35 drill, the hole tapped with a 6 × 32 tap and a set screw one quarter inch long inserted into each hole. The wire is fastened securely to the bottom set screw and the other end of the wire is wrapped around the top set screw. Attach the paper and smoke in the usual manner. After a record is made the wire is loosened from the top screw and pulled out and down with one hand, while holding the cut ends of the paper with the other hand. In order to avoid cutting through the record paste the two ends of the paper directly above the wire and start recording just beyond that point.

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[1] H. B. McGlade, SCIENCE, 91: 412, 1940.

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